SCIENTIFIC AMERICAN

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SEA SLED DASHING TO THE RESCUE OF A CRIPPLED AIRSHIP—[See page 342]

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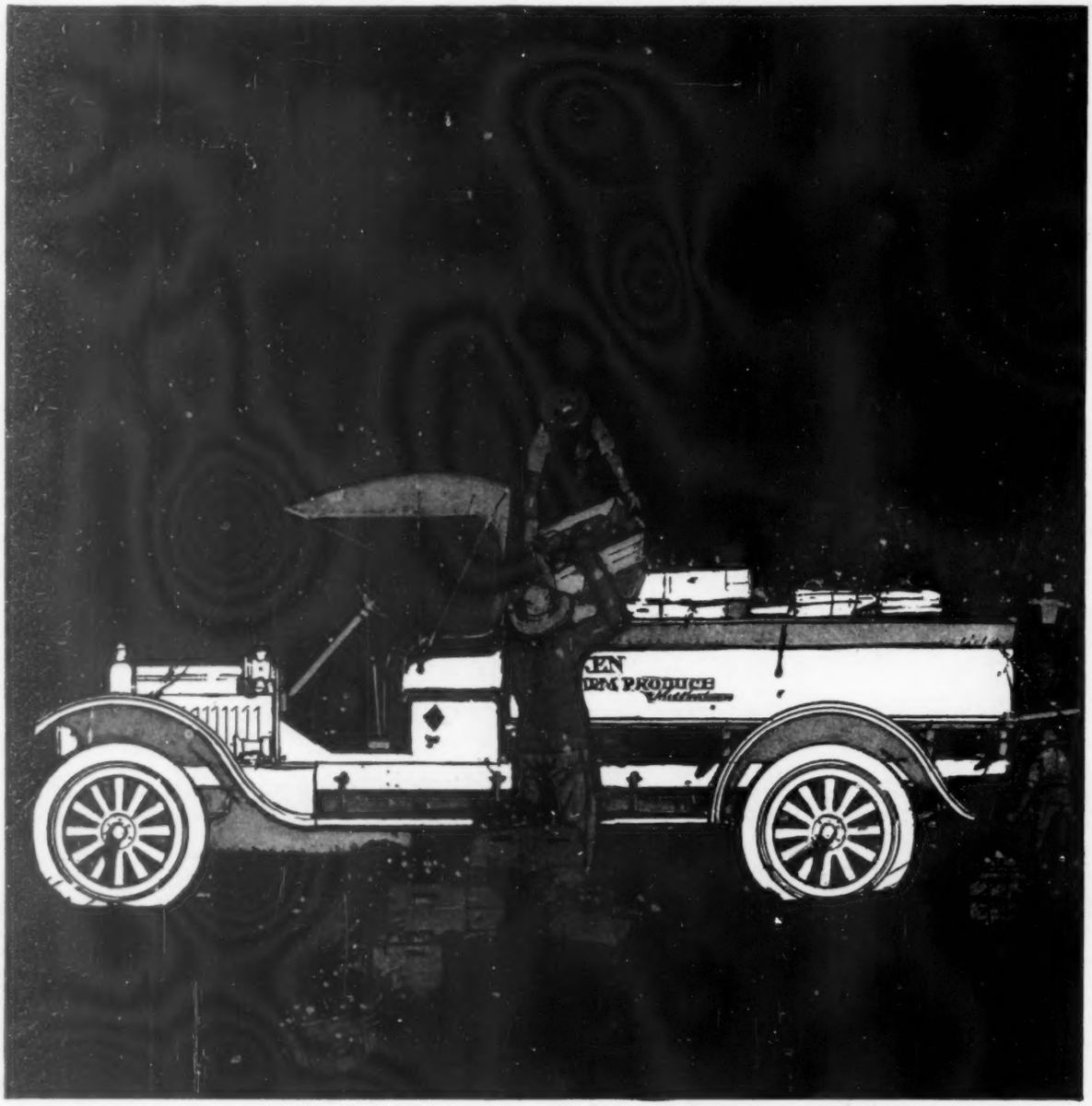


WHITE 2-TON TRUCKS

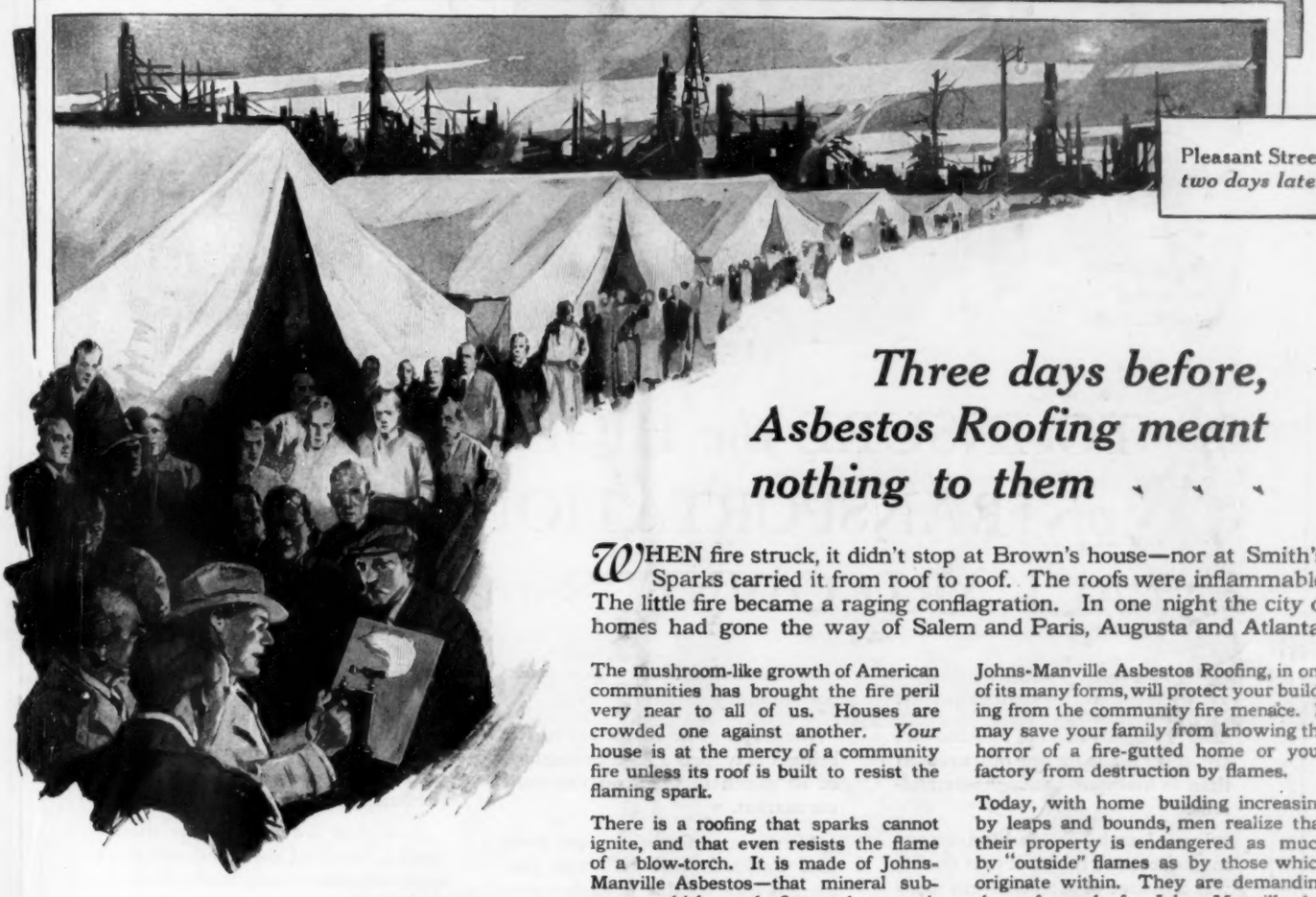
YEARS before the Great War brought the White 2-ton truck into military prominence, it had a position in *commercial* service unequaled by any 2-ton truck in America.

It won that position simply by *everywhere* doing the most work for the least money. This is a question not merely of fuel, oil and repairs, important as these are, but also of the factor so often overlooked—*volume of work done*. Keeping everlastingly at it means a big saving in haulage cost. 100,000, 200,000 and even 300,000 miles are not uncommon for White Trucks.

It was just this dependability in action which enabled entire transport formations in the French Army, equipped exclusively with White Trucks, to win the Croix de Guerre, and made White 1½—2-ton Trucks the Class A standard in the United States Army.

THE WHITE COMPANY, *Cleveland*

Pleasant Street
Aug. 6



Pleasant Street
two days later

Three days before, Asbestos Roofing meant nothing to them . . .

WHEN fire struck, it didn't stop at Brown's house—nor at Smith's. Sparks carried it from roof to roof. The roofs were inflammable. The little fire became a raging conflagration. In one night the city of homes had gone the way of Salem and Paris, Augusta and Atlanta.

The mushroom-like growth of American communities has brought the fire peril very near to all of us. Houses are crowded one against another. *Your* house is at the mercy of a community fire unless its roof is built to resist the flaming spark.

There is a roofing that sparks cannot ignite, and that even resists the flame of a blow-torch. It is made of Johns-Manville Asbestos—that mineral substance which repels fire and turns it back.

Johns-Manville Asbestos Roofing, in one of its many forms, will protect your building from the community fire menace. It may save your family from knowing the horror of a fire-gutted home or your factory from destruction by flames.

Today, with home building increasing by leaps and bounds, men realize that their property is endangered as much by "outside" flames as by those which originate within. They are demanding the safeguard of a Johns-Manville Asbestos Roof.*

Johns-Manville Asbestos Roofings:

Asbestone, Johns-Manville Standard and Colorblende Asbestos Shingles, Johns-Manville Asbestos Ready Roofing, Johns-Manville Built-Up Asbestos Roofing, Johns-Manville Corrugated Asbestos Roofings.

H. W. JOHNS-MANVILLE CO. New York City *10 Factories—Branches in 63 Large Cities*

**Nature—besides giving Asbestos its fire-repellent quality—has endowed it with extraordinary weather-resisting ability. It is a fact that a Johns-Manville Asbestos Roof will continue to give enduring service long after other roofings have had to be replaced.*

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

Through—

Asbestos
and its allied products

INSULATION *that keeps the heat where it belongs*
CEMENTS *that make boiler walls leak-proof*
ROOFINGS *that cut down fire risks*
PACKINGS *that save power waste*
LININGS *that make brakes safe*
FIRE PREVENTION PRODUCTS

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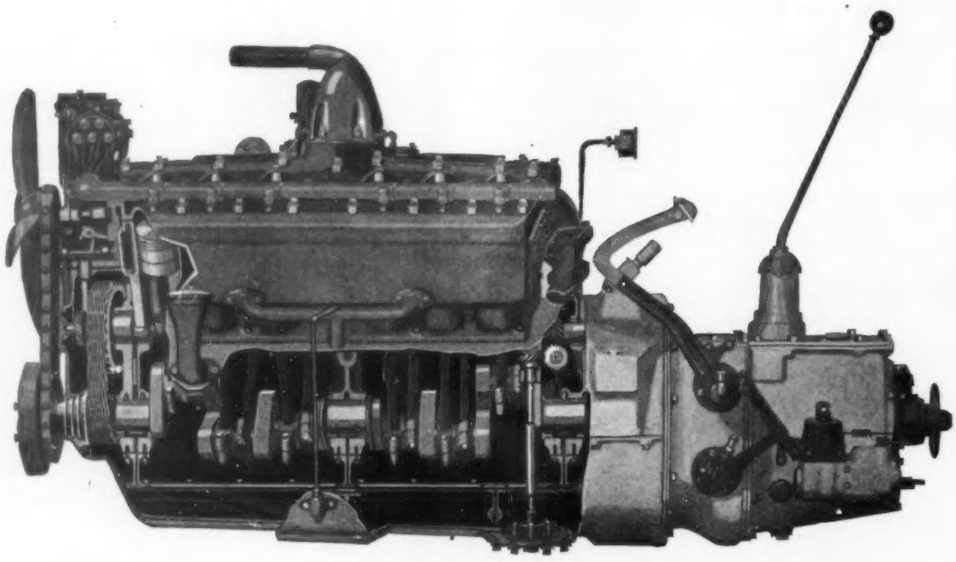

The PACKARD
System of
LUBRICATION

TO INSURE *the* HIGH QUALITY *of* TRANSPORTATION *to which* PACKARD OWNERS *are Accustomed*

IT is a fixed Packard principle that price is incident to quality.

Price advances in Packard cars are never made for any other reason than to maintain the highest standards.

It used to be the fashion among manufacturers to think that quality was a matter of materials—to think that it could be maintained solely by purchasing high grade steel and lumber and fittings.

The Packard people have always held that the spirit of the artisan is equally important and are confident that the advantage the Packard owner gets in the performance of his car is largely a matter of the quality of workmanship and the spirit of the workman.

A Packard price advance is interesting to the present Packard owner because it draws attention to the cash value of his investment in transportation.

We know of no motor car which brings today such a high percentage of its purchase price on the used car market.

Men whose first fine cars were *used* Packards will tell you that there is little gamble in such a purchase—less than in many an ordinary car fresh from the hands of its manufacturer.

To men about to purchase Packards, a price advance merely emphasizes the small percentage the first cost of their Packard is to the value of the transportation delivered.

When they buy a Packard they are buying the highest grade of motor car transportation.

They are buying the nerve rest which comes from traveling in the utmost comfort.

They are buying the true saving which comes from having speedy, reliable transportation at their call for business or pleasure.

And they are buying fifty thousand, a hundred thousand miles of such transportation, more if they wish, without the necessity for another initial investment.

Always with the highest possible used-car value to be cashed in at any time.

Because the miles are built in the Packard ready for the new man to use when the first owner gives it up.

Packard representatives are always glad to talk about the true value of motor transportation whether you are ready to purchase or not. You will find a call at Packard headquarters interesting and profitable.

"Ask the Man Who Owns One"

PACKARD MOTOR CAR COMPANY - - *Detroit*

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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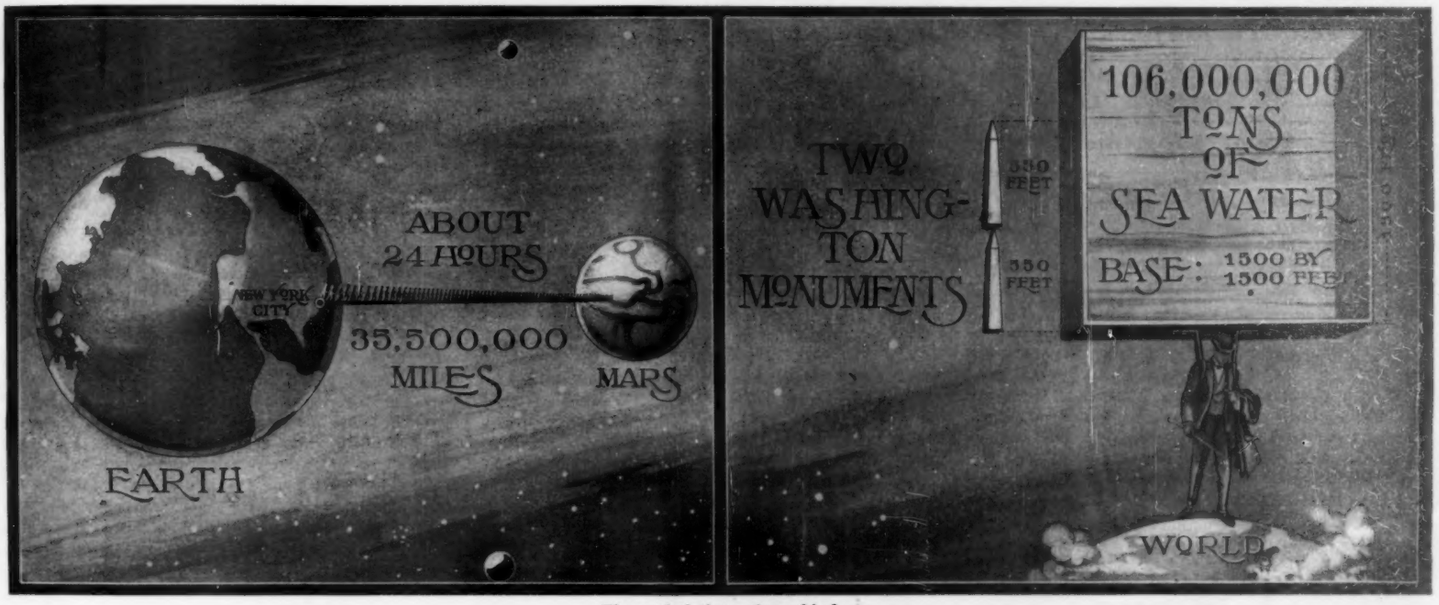

The ambulations of mankind

The distance walked by the entire population of New York City in 24 hours of uninterrupted business, would aggregate as far as from the Earth to Mars; while if all the walkers of the world could be combined into a single composite pedestrian, this modern Atlas would have to carry about with him a weight equivalent to that shown in the second drawing

What Walking Comes To

NATURE intended that man should walk—properly done, it is one of the best of exercises. And most of us walk more or less; though for some of us it is regretably less. After a careful consideration of mankind's ambulations, including young children and old people, and the fact that nowadays we have the inclination and the facilities to ride more and walk less than our forefathers did, a fair estimate of the average distance walked during twenty-four hours by the men, women and children of continental United States seems to be four miles. The postman and the policeman and the messenger boy walk far more miles than four; so does the farmer, though the use of the tractor has taken some of the burden of agricultural work off of shank's mare. On the other hand, lots of people do not walk four miles, or anything like that distance. Even for those who live sedentary lives, however, the sum total of the short distances walked from room to room during the course of the day's activity, from house to trolley or elevated station, from the car or the ferry-boat to the place of business, and so forth, amounts really to a surprising figure; so that the four-mile average is almost certainly not too high.

Still maintaining the balanced point of view of the man who talks in averages, this leads us to estimate that each citizen of our country walks, during the 16 hours of his waking day, a quarter of a mile per hour; or 22 feet per minute; or four and one-third inches per second. Casting our figures in the direction of enlargement rather than of reduction, the representative average American propels himself over a distance of 120 miles per month, 1,440 miles per year, a hundred thousand miles in the three score and ten years allotted to him in Holy Writ. He travels at a rate that would take him from New York to San Francisco in a little more than two years.

If we go beyond the individual walker, and integrate these results over the entire population of the country, which for this purpose we may estimate at 105,000,000, we arrive at the total of 154 billion miles to represent the total distance walked in America each year. Taking the next upward step, the entire human race, of some 1,700,000,000 members, hoofs it annually over a distance of no less than two and a half trillion miles. This is something like a hundred million times the distance around the world. It is ten million times the distance from the earth to the moon. If we seek an astronomical unit which shall be contained in it a moderate number of times, in fact, about the smallest one we can consider is the 35,500,000 miles that represents the minimum distance from the Earth to Mars. The quotient in this case is a paltry 70,000, which represents the number of times that the population of the world could walk to Mars in a year. If we go down again to a fraction of the human race, we can work it out that the population of New York city walks in twenty-four hours the distance to Mars when he is closest to us.

The inquisitive statistician might then ask how much work is done in connection with all this hypothetical pedestrianism. Well, the average weight of man, woman and child is about 125 pounds; so the population of the continental United States carries around with it at each of its hypothetical steps about six and one-half million tons. Lest this seem too severe a load, we may add that for the world's total population the figure mounts to 106 million tons. Verily, alongside this showing, Atlas, if he had to carry no more of the world than the ancients who created him knew about, would be what is known in the current tongue as a "piker."—*C. N. Holmes.*

Pacific Ocean Water in Domestic Use

RESIDENTS of San Francisco no longer need go out to the beach in order to enjoy an ocean salt water bath. Water is now pumped from the Pacific Ocean, a distance of 8½ miles, to a large bath house erected in the heart of the city. A 16-inch cast iron main projects 620 feet out into the ocean. The salt water is conducted through a system of 15 miles of pipe, by means of which are supplied various clubs, hospitals, hotels and chemical laboratories.

The main terminal, the Lurline Ocean Water Bath House, containing a plunge 65 feet by 140 feet and 2½ to 8 feet deep. The water is filtered before it enters the plunge, and it is constantly circulating and filtering. It is also subjected to electro-chlorine treatment, as directed by the Board of Health.

The water is taken from the ocean at the edge of Golden Gate Park, near the two wind-mills which pump water for irrigation purposes. The latter pump fresh water from underground springs and not ocean salt water as stated on page 515 of the SCIENTIFIC AMERICAN of May 17, 1919. Their proximity to the salt water intake has caused a good deal of confusion.

When the venture was planned the problem arose as to what kind of pipe should be used, since it was feared that salt water would soon corrode and destroy the mains. After experimentation, cast-iron bell-and-spigot pipe was adopted, and its use has proved very satisfactory. In buildings, piping in sizes up to four inches consists of cast *iron* pipe, not *steel* for cold ocean water. For hot ocean water, copper pipe tinned (iron-pipe size, not tubing) is used successfully.

Insulators from Kelp

EXPERIMENTS in Tasmania have shown that the Kelp (*Macrocystis*), an adequate plant with a wide range in the Pacific and Southern Oceans, in addition to its potash content so much discussed of late, can be made to yield a moist precipitate which can be pressed into any required shape and hardened by treatment with formalin when it turns perfectly in the lathe and takes a high polish. It is claimed that this material is suitable for insulators for electrical purposes and that it can be utilized in the manufacture of buttons and similar articles.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Justified Optimism

ALTHOUGH the average citizen may not know it, the men who keep their finger upon the pulse of the industrial and commercial world at large, are convinced that the lowest point in economical decline has been reached and passed, and that, in spite of the present unrest, the world is actually on the upgrade toward stable conditions and ultimate prosperity.

In stating this view the specialist does not mean that the restoration of normal conditions will come overnight, or next year, or for several years. But he has in mind certain encouraging facts, among the first of which is that the great waste of staple commodities which the war involved, has practically stopped. So has the destruction of life. Moreover, the twenty-five millions of men who were actively engaged in trying to kill each other have now, for nearly a year, been turning to active constructive effort. Again, we do know that, during the four and a half years of the war, the world was able to feed and clothe itself, even in spite of the vast amount of its resources that was being used up in the struggle. The toll taken in this way is no longer being exacted. Therefore, it is reasonable to assure that the world is gaining by the amount which it has saved by merely ceasing to fight.

We all know what a slow and wasteful operation was the transition from peace to war; and we are realizing that the transition from war to peace is almost as difficult. But the adjustment to peace has this advantage—that whatever progress is made, is positive progress. Every step is a move forward. Every industrial establishment that is set going on peace production is carrying the world just that much further from the manace of absolute collapse with which it was threatened.

Competent observers sent to Europe to investigate conditions have reported variously; but none who has read their reports, whether they concerned the late enemy countries or those of the Allies, can fail to feel that though the progress is slow, the upward movement shows signs of acceleration. Belgium is making a wonderful recovery. France apparently has passed the crisis and is setting herself to the task with the same indomitable spirit with which she fought the war. Even Italy, which experienced great disorders and was threatened with even greater, is showing signs of industrial improvement. England has faced her problems with characteristic courage and intelligence, and according to well-known observers in Germany, the discipline and common sense which had carried that country to such a high point of commercial prosperity, has won out against the forces of disorder and revolution.

Unlike many of the civilizations of history, the one which the world had built up before the war was thoroughly solvent. Each year it had sufficient surplus for a further extension of its benefits in opening up the backward parts of the earth and giving to undeveloped peoples the blessings which it enjoyed. But for four and a half years not only has this surplus been expended, but there can be no doubt that some of the potential power of civilization was also fed into the great mill of the war. How far this latter loss has been incurred is a matter of pure speculation; but the sum total of knowledge and experience is the same as before, in fact, it has been greatly increased; for it cannot be denied that the enlistment of all the scientific and engineering brains of the world in the effort to produce new weapons of attack and defense, has resulted in a great addition to our store of knowledge, and the development of many devices which can be turned to useful effect in promoting the arts of peace. Consequently, if every industrial plant and all the mechanisms of modern commercial life could be set going today, it would be possible to produce the same surplus which was regularly forthcoming in the prewar days.

One of the outstanding features of industrial development during the past generation has been the constant effort to substitute machinery for labor by increasing the output of individuals through labor-saving machinery. The urgent demands of the war naturally put a high premium upon labor-saving machinery, with the result that many industries find themselves in a position to show a greatly increased output without making any addition to their labor forces. Furthermore, it cannot but be that the military discipline to which millions of our young men have been subjected, and the habits of orderliness and promptitude which have been inculcated, will in themselves render the working forces of the country more efficient. All of this will go a long way toward offsetting the enormous loss of manpower due to the war.

It is true that, as the knowledge of the extent to which the world surplus had been exceeded spread in gradually widening circles through the world, it produced a feeling of panic among the mass of the people and caused grave concern even to the more thoughtful among us; but as one great financial authority has said, the most competent observers had already discounted the dangers of the situation by the time that the facts became widely known. As these trained observers reckoned up the world resources, they invariably reached the conclusion that the productive power of the world had not been impaired, and as their authoritative view became more widely known and their judgment was accepted, the widespread pessimism gradually subsided.

The same authority tells us that when once the solvency of Europe is granted, the problem for the American banker, manufacturer and exporter shrinks from an economical problem to one of finance; that is to say, it is a question of deciding upon the terms upon which credit may be most advantageously supplied. On both sides of the Atlantic the situation is identical in this respect—that settlements cannot be made until production has been resumed on the fullest possible scale. Europe cannot produce until food, raw materials, machinery and fuel have been secured from the United States, and these cannot be supplied unless our own production is kept at the highest possible level. Production to the limit is the key to the whole problem.

British Reduce Their Airship Program

A SURPRISING development of the past year was the enormous scale upon which Great Britain launched her new aviation program. The proposed expenditure, which totalled the enormous sum of over $300,000,000, covered several airships which were to be larger and faster than anything that had yet been attempted. In addition to the Governmental enterprises several large syndicates were formed for the purpose of promoting local, long distance and world travel, and the plans of these corporations, in the world both of finance and engineering construction, bordered on the sensational.

Since the announcement of these enterprises was made, strong pressure has been brought upon the British Government to exercise an all-around economy, and the pruning knife has already been taken in hand with most drastic results. In our last issue we showed what was being done in reducing the size and running expenses of the British Navy, one hundred and fifty of whose ships have been condemned and stricken off the list, including practically the whole of the predreadnought fleet. It is evident that the airship program is being cut down with an equally ruthless hand. The Air Ministry has decided to sell to private aviation firms a number of airships and also several airship stations, together with a large amount of stores.

That the curtailment is very severe will be realized when it is mentioned that among the numerous large airships to be sold is the one known as R-80, which has been nearly completed by Messrs. Vickers, and the huge R-39, which is being built by the Armstrong firm. Although the exact dimensions are not available R-39 is much larger than any airship in the service, including the famous R-34 which recently made the successful round trip from England to America and back. The Government is so much in earnest in this matter that, if it is not possible to find purchasers, some of the airships, because of the heavy cost of maintenance, will be demolished. It is probable that those ships whose construction has not advanced very far will in any case be broken up. The necessity for cutting more deeply into airship program than into that for airplanes is due to the enormous first cost of the necessary landing grounds, air sheds and mooring posts which, so far as the air sheds alone are concerned, practically doubles the cost of each ship.

We are told that probable purchasers for several of the airships will be the syndicate which has been formed to establish air service between Liverpool and New York and between Liverpool and Australia, for if these services are to be maintained with any reasonable frequency and regularity, at least six of the larger type of airships must be built or purchased.

Of course we were all aware that the high first cost of the airship was a serious handicap; but it is not so well understood that its life is very limited. In the hearings before the House Naval Committee, its useful life was given, if we remember rightly, as about two years. That, of course refers to the machines of today, and is due chiefly to the perishable nature of the canvas covering. In any case those who pin their faith to the heavier-than-air machines will feel that this drastic action of the British Air Ministry has discounted to some extent the airship and put a premium upon its smaller rival.

Making Safe the High Seas

ONE of the most welcome signs of peace for those who travel the high seas, has been the removal from merchant ships of guns, gun platforms, lookout-nests and the bizarre camouflage and their restoration to peace-time conditions. Not only does the passenger embark on a ship which has been restored her external grace and internal comfort, but she can steam on a direct course for her destination without fear of the bursting shells of the enemy raider, or the rending of her hull by a torpedo.

Not all of the war terrors were swept away, however, with the signing of the armistice; for, although the enemy might no longer sow the seas, the roadsteads, and the channels of maritime commerce with the deadly mine, the seas as he left them, were full of this peril. The Allies, of course, did their own share of mine planting; but since they possessed the charts of the mine fields, the peril was limited. The enemy also was required by the armistice to furnish full plans of his activities.

The work of mine removal has been a simply stupendous task, the largest part of which was the clearing away of the great mine barrage, 250 miles in length, which was laid by our own and the British navies. The greater share of the task, involving the laying of between fifty thousand and sixty thousand mines, fell to us and to us was allotted the task of their removal, which in its way, was scarcely less full of peril and less burdensome than the work of putting them down. However, according to dispatches from London, the work has been practically completed and we are given credit for its rapid accomplishment. Unquestionably, our North Sea mining operations, including the manufacture of the mines in this country; their transport to Scotland; the formation of a great mine laying fleet; the laying of the mines and their remarkably speedy removal, will always be set down as one of the major operations of this great war.

Engineering

A Concrete Ribbon Road.—There is a road near St. Augustine, Fla., which is paved with strips of concrete separated by strips of macadam. The road is 15 feet wide and at the outer edges there are two strips of concrete, each 30 inches wide, to take the outer wheels of vehicles. At the center there is a strip of concrete five feet wide. The intervening spaces are filled with stone and gravel. Not only does this make an economical road but it tends to distribute the traffic, keeping motor cars on their own side of the road, with a result that there is less danger of accident and less road wear.

Concrete Railroad Crossings.—In place of the usual timber planking at railroad crossings (says the *Engineering News-Record*), it has been proposed to use concrete for the road crossings of Wayne County, Michigan. These crossings will be made of standard concrete slabs which are fitted between the rails and also outside of the rails. The slabs will each measure 6 feet by 1.4 feet and will have a thickness equal to the height of the rail. The slabs outside of the rails will measure 2 feet in width. The purpose of using concrete in place of planking is to make the crossings smoother and to reduce the expense for repairs.

Paper Molds for Concrete Test Pieces.—The Bureau of Standards is now using collapsible paper cylinders in which concrete test pieces are cast. These molds are collapsible and may be nested for transportation purposes and can very easily be assembled when they are to be used. The molds measure 6 x 12 inches and weigh only seven ounces each, as against twenty-two pounds for the ordinary steel molds. They consist of two-ply cardboard cylinders slit lengthwise, which may be joined to form a cylindrical mold by means of a stapling machine. When the molds are used, they are left on the test-piece to serve as a protection during shipment. At the bottom of the mold a layer of neat cement paste is placed before the test concrete is poured in and the top of the piece is also covered by a layer of neat cement paste. These layers prevent the loss of water in the concrete and provide good finished surfaces for use in the compression test.

Why Don't Busy Rails Rust?—It has often been observed that the rails on the main track of a railway are not so liable to rust as those of sidings. The rail-heads on the main line keep bright while those on the sidings are soon badly corroded. Attention to this fact was drawn by George Stephenson as far back as 1843. It has been suggested that freedom from rust on the part of the main track rails was due to some galvanic action which was intensified by the vibration of the rails in use. However, one would naturally expect that the vibration would increase rather than decrease the oxidation. The true explanation is probably that the rail-head is kept clean by the traffic and is kept hard by the hammering of the rail while the wheels pass over it; also that a certain amount of oil is spattered on the rail from the wheels, all of which assist in preventing oxidation. Rust forming on the siding would collect and hold moisture causing further rust. A paper on this subject was presented before the American Electric Chemical Society by Oliver P. Watts.

Temporary Bridge Across the Suez Canal.—In order to conduct the campaign in Palestine a ferry was used to transport men and materials across the Suez Canal. This, however, soon proved inadequate and it was decided to build a temporary bridge with a swing span. This was constructed out of materials at hand in a period of 158 days. An interesting feature of the bridge is the novel form of the swing span. This span measures 155 feet in length. It is pivoted at one end to one of the piers and provided with rollers running on a roller path. The outer end of the span is supported on a lighter which is provided with an engine and screw propellers so that it can be self-propelled to open or close the bridge. At first steel lighters were used for this purpose but they were eventually replaced by a reinforced concrete pontoon which was the first concrete vessel ever built in Egypt. The pontoon is 98 feet long, 36 feet wide, and nearly 9 feet deep. It was built in a pit and after completion water was admitted into the pit to float it. An 80-horse-power steam engine was installed and this drives a propeller at each end of the pontoon.

Science

T. N. T. vs. Dynamite.—A contest was recently staged between 40 per cent dynamite and trinitrotoluene and the latter won out. Two concrete piers had to be blasted out and this gave an opportunity for a comparative test of the two explosives with the result that 14.9 cubic feet of concrete were removed per pound of T.N.T. and only 14.1 per pound of dynamite. T.N.T. is no doubt destined to be used extensively in engineering work as it is less sensitive then dynamite but greater precautions must be taken to ventilate after a shot, owing to the large amount of carbon monoxide which is one of the principal products of combustion.

Coronium in Natural Gas?—Messrs. H. P. Cady and H. McK. Elsey, of the University of Kansas report in *Science* that they are developing new spectroscopic equipment and methods for the purpose of definitely settling the question whether certain lines that have been frequently detected in the spectrum of specimens of helium, obtained from natural gas, are due to coronium, as has been suspected. Living and Dewar observed some "wild" lines in specimens of Bath gas which they suggested might belong to the spectrum of coronium. Cady and McFarland found lines corresponding closely in wave-length with the lines of coronium in the spectroscopic examination of samples of helium from natural gas, as reported in a publication of the Kansas University Geological Survey, "The Composition of Natural Gas."

Dredging Platinum.—A large dredge has been built in Scotland for the purpose of dredging platinum which has been discovered in the sands of a river in Colombia, South America. The dredge will be shipped in the form of plates and angles and will be assembled near the point at which it is to start operations. It is of the ladder type and the bottom trumbler of the ladder is protected as far as possible against the grit and sand in which it will have to operate while a self-lubricating device will extend the useful life of the shaft. An interesting feature of the dredge is the mechanism for warping it about. A series of warping winches are mounted on a common base and are arranged to be driven by a two-cylinder reversible engine. By a system of clutches the big dredge can be handled with perfect ease.

Disease in the World War.—Although medical science accomplished wonders during the late war in the eradication or reduction of diseases which have previously ravaged fighting armies, disabilities resulting from the war are due in more cases to disease than to wounds. An article in *Modern Medicine* quotes figures compiled by the English Ministry of Pensions showing that of all the pensions granted down to Sept. 1, 1918, 58 per cent were on account of disease. Tuberculosis and chest complaints were responsible for 11.2 per cent, rheumatism for 6.5 per cent, and heart disease for 9.9 per cent. Only fragmentary data are yet available concerning American experience, but of the 7,710 cases dealt with by the Federal Board for Vocational up to Jan. 31, 1919, by far the larger portion were due to disease. In fact, tuberculosis alone was responsible for 36.2 per cent, as compared with only 12 per cent due to wounds.

A New Text of Aristotle's "Meteorology".—For about two thousand years—down to the dawn of the period of instrumental observations of the atmosphere—Aristotle's "Meteorologica" was the standard treatise on meteorology. It was so regarded by the ancient Greeks and Romans, and then by the Saracens, who kept science alive while Europe was plunged in intellectual darkness. The scholastic philosophers translated Aristotle's works from Arabic into Latin and also made paraphrases and compends of them. Thus his treatises on meteorology and other branches of physical science dominated the thought of the world so long and so fully that they cannot fail to have had a great deal to do with shaping modern ideas. For these reasons the appearance of a new recension of the "Meteorology," by Prof. F. H. Fobes, of Union College, is an event of interest to the scientific world. Prof. Fobes has collated all the Greek manuscripts and also cleared up some difficulties in the Greek text by reference to the Latin versions current in the Middle Ages. The new edition is published by the Harvard University Press.

Automobile

Attaching Anti-Skid Chains.—The service manager of an anti-skid chain company advises that when replacing chains on the tires to be sure and have the hooks toward the back as you lay them over the wheel. This gives a whipping motion to the hooks when in use, which tends to keep them closed whereas if the chains are put on the other way they will tend to open and be in danger of coming off.

Madras, India, Has Auto Mail Service.—The motor mail van has found practical application in far off India. The postmaster at Madras recently experimented with three autos in the place of horse-drawn vehicles for the conveyance of mail. The experiment was said to be the first of its kind in India and to be so successful that the entire horse service is now to be abolished. Three motor trucks converted into vans were added to the first three and four other vans have been brought into use. The motor "fleet" of ten trucks fitted with mail carrying bodies is now complete.

Freight Car Shortage May Boom Trucks.—A reported anticipated freight car shortage during this fall may result in increased demands on the part of large motor truck users to bring their motor truck equipment up to date as well as having reserve vehicles on hand to replace those needing overhealing. The reasons advanced for this expected shortage is the poor condition of freight cars, inefficient manner in which rolling stock is being handled and putting off necessary repairs. As the railroads are expected to be returned to private ownership in a few months the Railroad Administration is not expected to place many orders for new cars. It is quite likely that the motor truck will again be used to make up for the deficiency of transportation, which will greatly stimulate the already booming automobile industry.

The Motor Era at Hand.—That we are on the verge of entering a nearly horse-less age does not seem apparent to the public because the change is being made gradually and we are so used to motor vehicles in practically all of our cities and towns that their greatly augmenting numbers and the corresponding reduction in number of horses used is not noticeable. There are recent happenings, however, that indicate this in a positive manner. A prominent metropolitan architect has stated that in over 80 per cent of the suburban homes he had designed so far this year, a garage for one or two cars was included in the specifications and that these were regarded as a permanent necessity was evident by the stipulation that the structures should be in keeping with the general architecture of the houses. A still more significant matter is the change in name of two well established blacksmith's trade papers to titles that would signify they catered to the automobile industry as well.

Motoring as Exercise.—Most motorists do not consider automobiling as exercise, providing there are no tires to change en route, and one frequently hears the opinion that the augmenting use of motor vehicles has materially reduced the opportunities for exercise that is so necessary to our physical well-being. A well known writer on scientific subjects, Dr. Henry Smith Williams, writing in a recent issue of *Motor* takes exception to this general view and states that automobiling is beneficial and shows accruing benefits under three heads—physical, mental and volitional. He proceeds to point out that in addition to the exercise, the motorist has been in the open air, buffeting the winds, inhaling ample quantities of oxygen to meet the increased needs of the accelerated currents of blood corpuscles; and that digestion and assimilation are thereby facilitated and the toxic products accumulated through former inaction progressively are in increased measures oxidized and eliminated. The doctor supports his conclusions in part as follows: "It is the muscles of the arms, together with those of the chest and abdomen, that pre-eminently and habitually suffer. When you drive a car forty or fifty miles over average American roads, or a fraction of that distance in the city, you give your arms and torso a course of purposeful calisthenics that redounds directly to the benefit of your muscles and arteries and heart and indirectly, but no less significantly, to the benefit of your digestive apparatus and organs of elimination as well as the nervous system."

The World's Horned Heads

The National Collection at the New York Zoölogical Park

By Dr. William T. Hornaday, Director

IT is now high time for the forming of systematic collections of heads and horns, to represent the great game animals of the world that so rapidly are disappearing. Such a collection is the next best thing to a well-filled mammal hall in a museum.

Eleven years ago the sportsmen of America offered to form such a collection for the New York Zoölogical Society, provided the society would accept it and handsomely maintain it. The offer was accepted, and the director of the Zoölogical Park offered his private collection to serve as a nucleus.

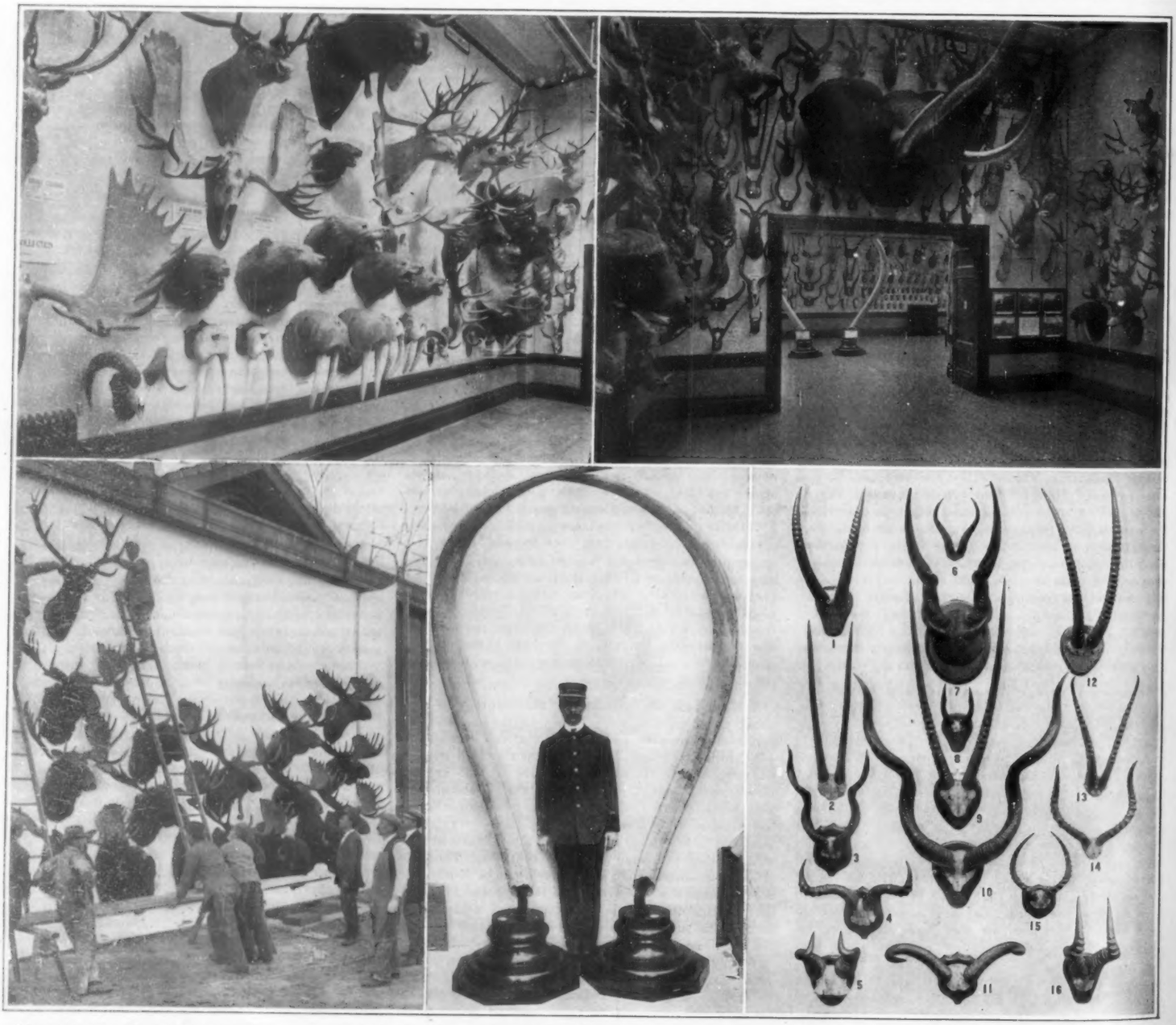
From that beginning, choice specimens, and funds for the purchase of specimens, have flowed in, until now the National Collection of Heads and Horns has attained international standing. We do not know of its equal anywhere. Good fortune has brought to it a great many genuine prizes, and it contains 17 first records for the world. That may be regarded as a surprising number to be found in one collection.

At the very beginning the collection was planned to consist of two series, each one ambitiously contain eventually a complete representation of all the living species of horned wild animals. The Geographic Series is to show the game by continents. In order that in a few glances the visitor may see the zoölogical riches or poverty of each grand division of the globe. Even in the present crowded and imperfect arrangement, the richness of Africa and Asia contrasts sharply with the poverty of Europe and South America.

The Zoölogical Series is intended to show the true relationships of the hoofed and horned animals of the world. At present this arrangement is only half wrought out; but even one glance at the great sweep of wall densely covered with heads and horns of the Deer Family is sufficient to show the zoölogical value of the idea. The group of "Ibexes, Goats and Markhors" is well along toward completion; the "Sheep" represent a good beginning, and the "Bison, Buffalos and Wild Cattle" are of keen interest. The antelopes of the world, the rhinoceroses, giraffes and wild swine have not been separated, because the space now available does not permit it.

At present this great collection is only to be regarded as temporarily stored in the Administration Building, which in truth it fills to overflowing. Into this office building the millions of visitors cannot be admitted, and at present admission is by membership in the Zoölogical Society or by card.

But an important development is pending. In 1916 ten persons subscribed $10,000 each to meet the cost of



Above: A vista through the temporary quarters of the National Collection of Heads and Horns (*right*), and a closer view of part of the Reed-McMillin exhibit of Alaskan game heads. *Below, left to right:* Hanging the Clarence Mackay gift of moose, elk and bison heads on a temporary canvas for the benefit of a photographer; the world's longest tusks, from an African elephant shot about twenty years ago; and the exhibit of African antelope horns

a sumptuous and suitable museum building especially designed for the Heads and Horns Collection. Unfortunately, just as construction work was about to be ordered, the war stopped the erection of the structure, and the soaring prices for labor and building materials have completely postponed the work until prices come down to the level of possibility.

The National Collection has been the fortunate recipient of a number of large gift collections. The nucleus gift soon was followed by choice collections of trophies from George L. Harrison, Jr., of Philadelphia, Edward J. House of Pittsburgh, Percy C. Madeira of Philadelphia, the great Reed assemblage of Alaskan heads from Emerson McMillin, and the matchless Clarence Mackay collection of giant Alaskan moose, Wyoming elk and bison. Five New York gentlemen, Messrs. Frederick A. Schermerhorn, Lispenard Stewart, Frederick G. Bourne, Charles F. Dieterich and W. D. Sloane combined their interests and purchased for us the South African collection of prizes known as the F. H. Barber collection. Mr. George J. Gould purchased for us the historic African collection of Dr. A. Donaldson Smith. Messrs. Newland, Tarleton & Co., of Nairobi, B.E.A., gave a fine series of British East African heads, and John W. Norton added a choice and valuable series of his African trophy heads.

Of the individual pieces, the most notable are the splendid white rhinoceros head from Col. Theodore Roosevelt, an okapi head from Herbert Lang through the American Museum of Natural History, four superb caribou heads from Wilson Potter of Philadelphia, and a grand pair of Irish elk antlers from the late H. Casimir de Rham. Among the first and finest gifts were a Chinese takin from Mason Mitchell, and the longest and most beautiful pair of African elephant tusks ever known came from the late Charles T. Barney.

It is impossible to mention here even one-tenth of the other fine individual specimens presented by generous and self-sacrificing sportsmen, many of whom gave up their finest trophies to place them here, forever.

The anatomical collection, skilfully prepared under the personal direction of Raymond L. Ditmars, is a very interesting feature. It was designed to explain and illustrate the differences between horns and antlers. Incidentally it shows how it is that the prong-horned antelope, growing a case of true horn over a bony horn-core, is able to shed that outer horn and renew it with the coming of each season.

A fair example of how this exhibit is got up is shown in the single cut on this page. At the left, we have here longitudinal sections of the horn and bony horn-case of the Rocky Mountain sheep. Beside it, at the top of the picture, are similar sections from the prong-horned antelope. These are shown again, but from a somewhat different viewpoint, at the bottom of the cut, toward the right. The long, curly appendage that comes next, at the top of the photograph, is a horn taken from a Cape hartebeest, while at the extreme right we have a longitudinal section of a deer's horn.

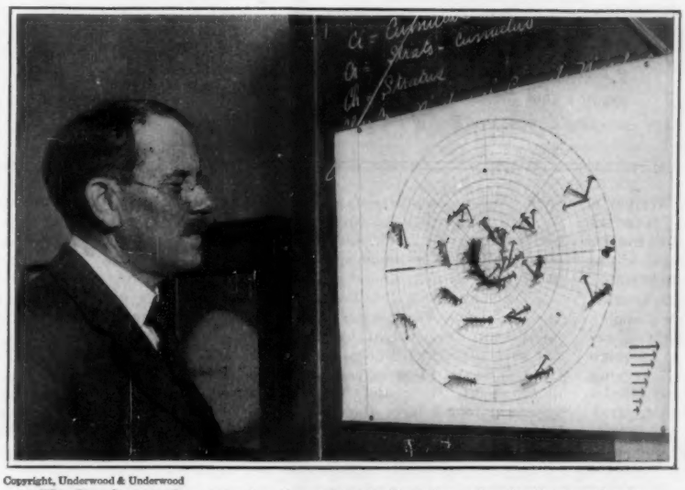
The home of the National Collection of Heads and Horns is now the place in which most disputes about horns and antlers are settled by the authority of actual specimens. The labels give the measurements of the various objects they describe, and he who runs may read.

A few years hence, when the prices of labor and building materials are no longer at the summits of their respective peaks, and when Reason once more regains her throne, then—and not until then—will the Heads and Horns Museum be erected and occupied. Then will the world see two arrangements such, we venture to say, as never before have been seen under one roof. The money is ready, the building site is ready, and the public waits with impatience for the privilege of viewing this matchless collection in its entirety on every day of the year.

For the peace of mind of all humanitarians, it should be stated that of the whole 878 specimens in this great double collection *only ten were shot expressly for it!* It thus appears that only a very small percentage of these killings are in any way chargeable to the Zoölogical Society. The National Collection has been formed by the gathering of extra fine heads, shot and preserved in the long ago, when big game was plentiful and cheap.

A lesson in horn structure, which is more fully expounded in the text

A word in interpretation of the cut at the lower right corner of page 338 may not be amiss. These horns are all from members of the antelope tribe. The numbers identify them as pertaining to the following species: (1) Baker's roan antelope; (2) the baisa, a large cow-like creature from northeastern Africa; (3) the lesser kudu, a striped, hairy species that ranges from Abyssinia to the Cape; (4) the Tora hartebeest; (5) Lichtenstein's hartebeest; (6) the springbok, which owes its odd name to the impression which its extreme agility in getting under headway made upon the early Dutch colonists; (7) the eland, perhaps in general appearance the clumsiest of the antelopes; (8) the harnessed antelope; (9) the gemsbok oryx; (10) the greater kudu; (11) the brindled gnu; (12) the sable antelope; (13) Grant's gazelle; (14) the pala or palla, a little known red antelope of Angola; (15) Hunter's antelope; (16) Jackson's hartebeest. All photographs are copyright by New York Zoölogical Society.



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The handy weather map for the aviator's direction, showing atmospheric conditions above the earth

Portable piledriver for the use of army engineers but available for peace-time employments

Keeping Track of Winds for the Airman

Of course the aviator is greatly dependent upon the wind; and a great deal has been written on this head. We are told, for instance, that if he does not like the wind at one level it is his privilege and his duty to seek another level at which the prevailing air currents are more favorable to his voyage. But this assumes that the pilot knows where to seek such a favoring wind; and this is not always in accord with the facts.

The United States Weather Bureau is greatly interested in the meteorological problems that confront the aviator, for it sees here an opportunity to get its findings into immediate practical application in a way which the still uncertain ground-weather predictions can not yet hope to duplicate. The Bureau has accordingly paid a great deal of attention to investigating wind conditions aloft. It will be recalled, for instance, that during the period preceding the transatlantic flights, one of the Bureau's men was constantly at hand in Newfoundland to advise the aviators as to weather conditions over the ocean, while there was likewise published by the weather man a comprehensive discussion of all the meteorological considerations involved in transatlantic flying.

Considerable new equipment is called for in the effort to take good account of the atmospheric conditions above the earth. The element of altitude has always its significance, but never such a paramount one as in this connection. We illustrate herewith one of the new ideas, a wind map which shows how fast and from what quarter the wind is blowing at various altitudes. This, of course, is not an instrument of observation; it is simply an ingenious little scheme for recording in most convenient form the results of observation and inference. But as an ingenious scheme it surely takes front rank.

The wind is represented by arrows. The direction of the arrow indicates of course the direction of the wind; its length is proportional to the velocity. The height is indicated by the concentric circles which form the background of the diagram; the quarter in which the observation is made is shown by the position of the arrow on the circumference of its circle, and a convenient means of reading of this feature of the map is afforded by printing in a few of the radii.

Lest someone ask what is the distinction between the crossed arrows and those that are not crossed, we hasten to state that none of them are crossed. What appear to be crossed arrows are merely overlapping arrows, where winds of substantially the same direction but varying velocity have been found at different times in the same point.

Portable Piledriver for the War-Time and Peace-Time Job

WARTIME conditions showed the necessity for a piledriver outfit strong enough to do heavy work and yet light enough to be readily transported on its own wheels. Such a rig was developed; furthermore, it can be be used as a drill with which to dig holes for telephone posts, as a steam shovel, or as a derrick. The drop hammer provided with the outfit weighs 950 pounds, the power for operating it being furnished by a 30 h.p. gas engine located at the front end of the upper frame. This movable upper frame also carries the A-frame boom and hanging leads and hoist. When the machine is being hauled, the leads and boom are folded down compactly, and the hammer is carried in a housing at the rear end of the frame. The A-frame boom is pivoted to the sides of the upper frame. The leads are 25 feet in length, with a 17-in. spread. The extreme height from the bottom of the wheel to the top of the leads is 32 ft., making it possible to take a pile about 30 feet in height above the wheel base.

The outfit is being rapidly brought into use in the U. S. Engineering Corps work and is proving of decided value because of the many purposes for which it can be used and the readiness with which it can be transported. Apparently it should be of as much value to the civil engineer as to his military colleague.

The Romance of Invention—III

The Patent That Flew

By C. H. Claudy

FEW developments of modern applied science show so many odd contradictions as the art of flight.

The first man to prove that it was possible to support a heavier than air mechanism in the air by self-contained mechanical power, died of a broken heart because the public laughed at his demonstration.

The most eminent mathematician of his time demonstrated beyond a doubt, by mathematics, that it was impossible for a man to fly in a heavier-than-air machine.

The original invention which made the development of mechanical flight a practical, not a theoretical possibility, is no longer used in any flying machine.

The first patent ever taken out in this country for any sort of flying machine was for a type which has never yet flown, the helicopter.

The country which was home and father to mechanical flight was, prior to the war, the least regardful and the most neglectful of the development of that art.

Yet the first transoceanic flight was made by an American in an American-made machine, and the first aircraft engine to be successfully put in quantity production was the Liberty engine.

Few great steps in invention have not been vigorously disputed by rival claimants. Shakespeare did not write his plays, Columbus did not discover America, Seldon never invented an automobile, Bell a telephone, Edison an electric light or Wright a flying machine, if one believes the history of claimants . . . even sometimes if one can believe the courts. But to the man in the street at least, the proving of the flying is in the doing, not in the courts. Regardless of what Lilienthal did with a glider, Chanute with wings, Montgomery with kite structures, or Langley or Ader with steam driven mechanisms, the fact remains that the first heavier than air flying machine to get off the earth under its own power, carrying a man, and staying in the air, was the flimsy, ill-designed, ineffective and, by today's standards, altogether inefficient Wright flying machine.

FEW great steps in invention have failed to bring forth counter-claims, vigorously supported. Shakespeare did not write the plays, Columbus did not discover America. Selden never invented an automobile, Bell a telephone or Edison an electric light—if we can believe rival claimants. But in the eyes of the man in the street, proving is doing; and regardless of what others may have thought and attempted and demonstrated, the fact remains that the first heavier-than-air machine to get up and stay up, carrying a man, was that of the Wrights.—THE EDITOR.

The Wright patents are remarkable rather for what they do not say than for what they do. The so-called fundamental patents were for a something which today the airman laughs at . . . a means for warping the wing and turning the rudder at the same time, that one could not steer to right or left without banking, and that one could not slip into a bank without a right or left turn to keep from falling. In the light of the present day acrobatics, the precautionary coupling of rudders to warping wings seems absurd. But it was not absurd. . . it was the thing which made flying possible, for before man might fly successfully, he must have experience in the air, and how could he gain experience in the air without flying successfully and safely?

A thousand balladists have sung peans of praise of the daring of great airmen. But no flying man who fought, no cross-country adventurer who flew, no pilot who pointed his plane across the landless reaches of the ocean, showed a higher type of courage than did Orville Wright in 1908, when with exactly seven minutes in the air for experience—and that taken lying down—he stepped into his plane, in front of ten thousand hostile skeptics and flew once and a half around the parade grounds at Fort Myer, Va., near Washington. Those who fought, those who tried for the cross-ocean prize of glory knew their machines would fly. . . remained hostile men or hostile distance to conquer, only. Wright knew only that his machine *should* fly and that if he could do what he knew he should do, he might go up and would come down. . . somehow. But he had never done it, and there was a waiting world anxious to tell him he never could do it.

But he did it.

Let no one think that credit is here given to Orville Wright at the expense of that which should go to his brother Wilbur. Wilbur Wright, at Le Mans, was getting ready to fly when Orville flew, and was the butt and sport of every wit in Paris. With little money and no style, cooking his own meals in a crude wooden hangar, doing his own work, smutty with grease and with the man of science and the gentleman well concealed in overalls and a sphinx-like attitude toward inquirers and critics alike, Wilbur Wright was not a romantic figure. . . until he flew.

Both the brothers always claimed that their invention, discovery, call it what you will, was their joint work. . . that neither contributed more to the solution of the problem than the other. Wilbur, who died in his bed of typhoid, Orville, who almost died in the first accident to a powered plane which resulted in a fatality in 1908, acted upon each other like flint upon steel. When one proposed an inquiry, the other reached for pad and pencil to solve the problem. When one had an idea, the other added an improvement. When one tried an experiment and failed, the other was at hand with comfort and encouragement.

There have been few inventors of epoch-making devices who were less satisfactory from a public standpoint than the Wright brothers. They did not like nor seek publicity. It was about as difficult to lionize them as make them talk. In 1908, when Wright was alone at Ft. Myer and in 1909, when both brothers appeared to complete the government tests, so rudely interrupted with the accident of the first year, fatal to Lieut. Selfridge, they were continually surrounded by a small army of lynx-eyed newspaper men. . . scribes who had just finished with Captain Tom Baldwin and his dirigible, and who had found in the old circus performer not only a capable aeronaut but a born showman, always willing to talk and give forth a "story."

The Wright brothers had no stories to tell. They would make no predictions. They explained no theories. They would not comment on other inventors and their attempts. All they would do. . . and this they did with absolute fidelity. . . was to tell the reporters "we may fly today" or "there will be no flight today." At first the newspaper men didn't believe. . . they hung around for hours at a time in spite of the assurance that they were wasting time. Later they learned that if a Wright said "no flight" he meant "no flight."

The conquest of the air has cost many lives. Many of these have been foolishly expended and brought no gain to the experimental world. Others have taught much and many a man flies in safety today because some other man has laid down all he had, to learn. This can be said of the first accident to the first plane ever to fly consistently. Orville Wright was the pilot, Lieutenant Selfridge the passenger. It was Wright's theory that "safe and sane" flights consisted of circles, always to the left, above the parade grounds at Ft. Myer, always in such a position that should the engine stop he might glide safely to earth, and never at a height so great that that glide would be at a dangerous speed. So when the inevitable happened and a tail fitting now known to be far too flimsy for the strain it had to take, wore through and broke, the released guy wire caught in a propeller blade and snapped it and the machine turned, lost speed and then nose-dived, there was no space with which to flatten out the curve. Selfridge paid with his life, Wright with broken bones and many cuts which kept him flat on his back in a hospital for six weeks.

It is no apochryphal tale that Wright's first thought after recovering sufficiently to think was, after Selfridge, for the cause of the accident and that he would fly again as soon as he could. His faith in his invention was never stronger than after it had laid him low. And it is strange but true that it was while he lay in the hospital that he made about the only prophecy he was ever known to make regarding aviation, that the machine of the future would not be that which could fly the fastest, but which could fly the slowest. A hundred laboratories today are searching for the means to make an airplane fly slowly that it may land and rise from a confined space. . . before aviation was fairly demonstrated as a possibility the inventor of the principle which made it possible had forseen the ultimate machine.

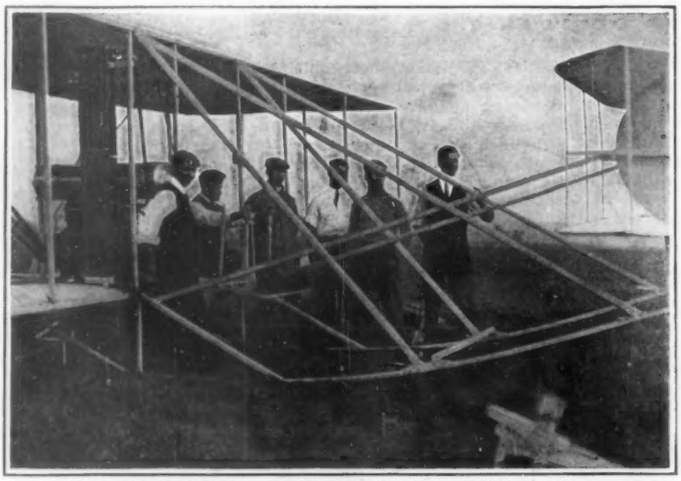
There has been much popular misconception in the public mind as to just what the Wrights really did for aviation. The principle which they worked out was that of the warping wing . . . the cambered surface which could be so twisted out of shape that one end offered a greater, the other a less, resistance to the air, thus tipping the machine, or, *per contra*, offering a means of overcoming a tipping caused by wind puffs or unevenness in the supporting medium. With this they combined the horizontal rudder, so that any turn must be banked or any bank a turn.

The machines of today do not "warp" their wings . . . hinged flaps, called ailerons, diminish or increase the wing tip resistance.

There is no connection in the modern plane between a rudder and aileron. . . the pilot may, if he choose, slither around a turn without banking, or bank and sideslip without turning. All the complicated and daring evolutions of the aerial stunt performer are possible because all the three controls. . . lateral rudder, vertical rudder and wing tips are actuated separately.

Wright's early plane was flung into the air from a catapault. . . it ran on a rail and received its initial impulse from the power of gravity acting through a falling weight. It landed upon skids, like a sled, and required a perfectly smooth space, or disaster resulted. Today's machines start under their own power and run on wheels. The Wright machine was a pusher. . . practically all modern planes are tractors. The Wright machine had two propellers from one engine . . . a form of construction which is never seen today. The Wright machine of 1908 had two controls, one for either hand. . . one was rudder and wing-warp, the other vertical elevation or depression. Today's plane steers right and left and up and down and tips the ailerons with a single joy stick with four motions and a foot control, leaving one hand free for some-

(Continued on page 350)



One of the first Wright planes, with front elevator and without wheels, which demonstrated its ability to make a sustained flight

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The International Language

To the Editor of the SCIENTIFIC AMERICAN:

Perhaps a year ago you gave us, in an editorial entitled "Science and the International Language Question," a careful survey of this very appealing subject. You rather effectually discouraged any hope of immediately solving this perplexing problem, either by agreement on one of the modern or classical languages, or on an artificial speech of which Esperanto is a representative type. But you overlooked an important possibility. Yours seemed to accord with the popular view that, though the artificial languages have failed to win a practical success, this is not due to any fault in their design. But this conclusion seems premature.

Another possible solution is in the design of a speech-type more independent of the form and more consistent with the purpose of speech as we know it; and, before dismissing the subject, I want to point out the theoretical weakness of the above noted types, and how it is possible a more consistent design may supply the missing key to this complex problem. This logical design, though less readily arrived at, gives more promise of really solving the problem in a practical way; and, unless it is impossible to "fit the human brain" with a rationally designed speech, this freer treatment of the problem affords a most promising field of research.

The scheme for a logical speech implies an intelligent adaptation of alphabet, vocabulary and syntax to give the greatest simplicity, flexibility, precision, and the many other qualities required. Further, this system should merit the name "Science" of speech in the sense of thoroughness which this term implies in the sciences of mathematics, physics or chemistry—in embodying all the essential data on a given subject, the proportionate value of each detail, and a correct theoretical basis for the laws governing the relations of each element with all the others. This implies an immense task, but no champion of any present system claims it complete.

Whether it be possible to devise a practical scientific speech is an open question; for, as you say, "Natural languages grow up in consequence of complex laws which are only imperfectly known." But, with sufficient effort, we may expect to discover these laws, and, these once mastered, to determine a speech-type so obvious and effective as to defy any competitor. It may not be impossible to develop a speech as consistent as the theorems of Euclid or the laws of the physical sciences, yet so thoroughly effective that it surpasses any present conception of speech. In any case, chimerical as it seems, it may be possible to go further in revision than any artificial language has yet gone, and design a speech whose perfection will command universal confidence and supply another incentive to put the international language to work.

One weakness of the artificial languages is because their authors, overawed with the difficulty of their learning, closely followed our native tongues for the expediency of making them the easier to speak. This expediency may or may not be necessary, but, at least, it hardly accords with the scientific method and, in several ways, tends to defeat its own purpose.

First, speech is a rather complex total; the difficulty of learning is secondary to the resulting value, and this, owing to its being a social institution, depends on the importance of the other speakers. So confidence in its success as the international speech seems of more value than obvious familiarity. As no system has yet inspired the needed confidence in its success, the years seem only to add to the number and the confusion with little advance to the goal. Nor, from their theoretical nature, is this surprising. They are not scientific, though the status of Science in the modern world suggests that its method should be sought to shape a system so important as the future world language, and its prestige needed to give confidence to the result. Lacking these, we may expect a language of expediency to be of little permanent worth.

Second, after following the expediency of copying the native speech, it is even doubtful if the resulting artificial languages are much easier than is afforded by following more original lines. Henry Sweet expresses the mature conclusion that "all languages are equally difficult;" that if simpler in one feature of grammar, a given language is more difficult in others. Moreover, instead of grammar, the vocabulary gives the most trouble, and *this is essentially arbitrary* in all types, including the artificial speeches. As a science, the rudimentary character of some ideas concerning speech suggest something of the state of other sciences when the leading lights were seeking the elixer of life, and the philosopher's stone.

A third objection to accepting the present models as final is absence of suitable methods for comparing with each other, and of critical standards to replace the authority of tradition. True estimates of the relative values of all the elements of speech may be remote, but we may expect many elements of our problem stated in simple terms that allow intelligible comparison with each other.

A simple illustration of a standard of comparison may be seen in the average volume of the words of the vocabulary. Other things equal, it is usually supposed the shorter words are more forceful and effective. Assuming it is desirable to confine the words to the smallest limits, a comparison of the actual words with the possible minimum is enlightening as to their efficiency in this respect. Thus, the alphabetic sounds in common use in English combined in all the ways for forming practical words of a single syllable give a total of perhaps 100,000; more than the total of most languages or the power of any individual to master. This is a vocabulary of consequence, but if insufficient, each in turn may combine with all the others and so form enough words of two syllables to approach infinity so far as the possible needs of speech matter. So the actual range of our words up to six or more syllables makes an altogether modest showing for efficiency by this crude measure.

The total number of vocabulary terms needed, and the extent to which our speeches are redundant and defective in this respect, likewise readily lends itself to analysis, but the analysis is overlooked and much is left in vagueness. Ours is credited with more than 400,000 words while French, German and other languages manage with only a fraction of this number; the individual speaker, in any case, rarely masters more than a small proportion of the words in his speech. All speeches are probably needlessly extravagant in terms when these make such a difficulty in language unless the form systematically suggests the meaning. This it does not, except in a minute way that is offset by the same similarity of derivation of terms unrelated. Esperanto is slightly better in this respect than our native speeches, but it is too close to them to stand out in any notable contrast. While we still require additional terms with the growth of knowledge, these will be related in meaning with our known words, and if composition is similarly related so as to suggest their meaning, the vocabulary may be indefinitely extended if the additional terms be simple and less unwieldy than their equivalent in phrase or clause.

The number and volume of the words of a speech are, perhaps, unimportant, but they serve to illustrate how rudimentary is our knowledge in some phases of the problem, and, somewhat, how we may expect to approach all the elements of the problem of the international speech by the scientific method. There is a multitude of details that require intelligent treatment within themselves as well as in their relation to all the other elements of the problem which makes any hasty conclusion rash. Avoiding the obvious grammatical irregularities is necessary, and has been emphasized in all the proposed languages, but, compared with many more fundamental irregularities that have been overlooked, these seem trifling. If it is useful to have the plural of nouns and the tenses of verbs formed regularly, it may be as useful to have the sentence structures expressing similar ideas of the same type. Idiomatic expressions might be improved by being put in more consistent forms, and whole categories of constructions might be transformed with a gain in force and simplicity by slight changes in some of their elements. If many anomalies besides the inflectional forms may be pruned off with advantage, there are possibly other features never made use of in speech that would prove of advantage, and, altogether, this affords a fruitful subject of inquiry but space is too limited to go into it here.

Then, the international language, though appealing, is balked in the difficulty of learning and the greater difficulty of choosing the type to be learned, because we have no sufficient knowledge of the problem to warrant a confident conclusion. Though some of the artificial languages are "marvels of ingenuity" in some respects, the same may apply as well to many proposals for perpetual motion, while most great inventions are essentially simple. The whole problem is largely neglected, because so much needed data is lacking, but we do not yet appreciate our failure in this respect or the means of mending it. Science, with its many successes in other fields, has been too occupied with these to take note of the necessities of the international language to become practical, or to outline a speech type that commands confidence. But the game is still young, and there are unlimited prospects of success.

E. E. PORTER.

Carnegie, Pa.

The Through Bill of Lading

To the Editor of the SCIENTIFIC AMERICAN:

The long and interesting letter published by you, being written by an Australian merchant on the Through Bill of Lading has had my careful attention and I can appreciate the troubles, difficulties and loss that arises by the non-delivery of shipments and the seeming impossibility to fix the liability.

Knowing the circumstances I suggest overcoming them in two ways, as follows: If goods were ordered on letter of credit, the credit should read, Draft at (say 60 days) sight *"after arrival and inspection of goods,"* and if bought without a credit the draft attached to bill of lading to read the same way. This would mean that the draft comes forward and is held by the bank and not accepted by you until the *goods arrive and are inspected* by you to see if they are all in order before you put your acceptance on the draft.

If your American manufacturer will not accept a credit of this sort but requires a sight draft at time of shipment then you will have to go to a commission house and pay commission and extra interest for the approximate time the goods are in transit.

The "Through Bill of Lading" is a splendid document when not abused, but the best service is to have an agent at port of shipment and pay him for tracing and watching of the transfer. We used to send a photograph of the shipments, showing marks and packages so the transfer agent could find them easily.

M. HALL MCALLISTER.

San Francisco.

Who Started It?

To the Editor of the SCIENTIFIC AMERICAN:

You are so precise in your ordinary explanations that I should like to read your idea, stated with like precision, of where present high prices started.

For instance, taking 1914 as a year of normal prices, who was the first to become aware of the change in the gold quotient, and how did he acquire his information?

For instance, you stated that you raised your subscription figure because the pulp man charged you more; you didn't lay it to the gold supply. Well, if the pulp man charged more, not on account of the scarcity of spruce and pulp, as then stated, but because of gold, how did he learn about the gold situation? And so on, back to the first price-booster.

During the Civil War, when it was a toss-up which side would win and make the currency of the other side valueless, flour in the South went to $600 a barrel on the sporting odds, and gold here went to premium, and the importer naturally charged more to recoup himself. But in the last war there was no excuse of that sort, and now everyone has perfect confidence in the Government's solvency, and in the value of the Federal Reserve notes.

The point is, who was the first of the present price-boosters, and how did he come by his information about the gold situation? Is it not, perhaps, that he knew no more about the gold situation than the pulp man did when he raised the price of your subscription, but saw his chance and took it, just as our other 17,000 war millionaires took theirs, the boost of each one of them shoving up the prices of the one next to him?

J. R. SMITH.

New York.

Daylight Meteor

To the Editor of the SCIENTIFIC AMERICAN:

I read in the August 2nd issue of the SCIENTIFIC AMERICAN a letter describing the appearance of a daylight meteor seen in the United States. A meteor very similar to the one described was seen by me about five years ago; it appeared in the south and traversed an arc of about twenty degrees, moving in a westerly direction; it was from twenty-five to thirty degrees from the horizon. In size it was almost one-third the area of the moon; it shone with a yellowish light and was seen about 5 P. M.

A. MOZLEY.

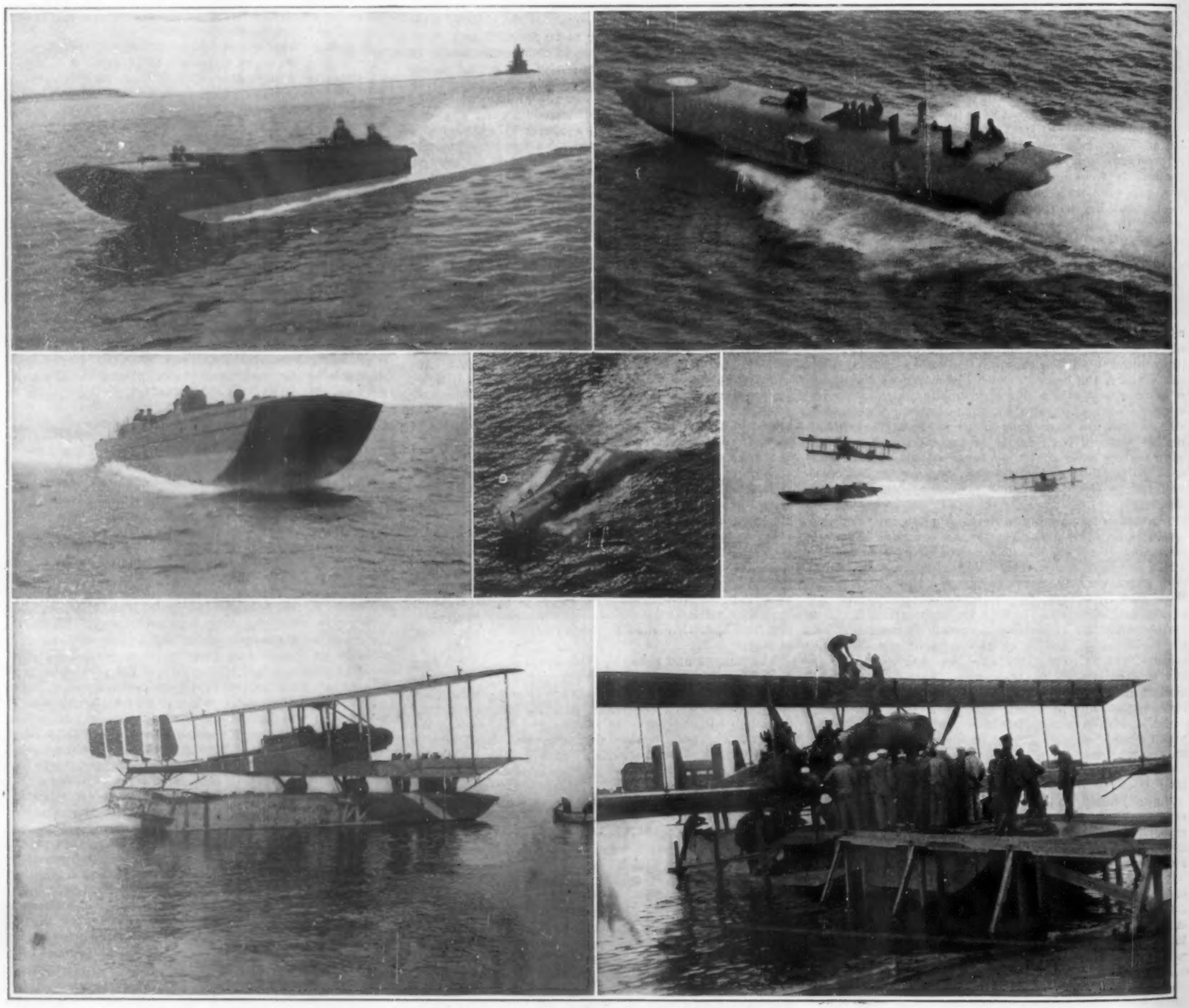
Winnipeg, Can.

The Sea Sled

A Remarkable Boat That Skates on the Water at Incredible Speeds

A YEAR or two before the war Mr. Albert Hickman published in one or two of the motor-boat magazines a description of his experiments with what were called surface-propeller boats. The submerged screw propeller had many disadvantages in high-speed boats. The propeller itself was so small that cavitation in rough water was frequent; the under-water shafts had to be reduced to the minimum to eliminate as much resistance as possible; and still, shafts, shaft-hangers and hub and roots of the blades of the propellers, while not of direct working value, had to be dragged through the water when the boat was at speed, the dip being regulated by the position of the propeller shaft in relation to the bottom of the boat and by the inertia of the water with the boat running. As only the lower blades of the propellers were immersed, this arrangement necessitated the use of two propellers turning in opposite directions to eliminate side thrust, and the surface propeller—the dipping propeller with regulated dip—became an accomplished fact.

The surface propeller was first tried, not in hydroplane boats, but in small boats traveling sufficiently



The sea sled in action from many viewpoints

Above we have the 30-foot ordinary sea sled and the 50-foot airplane-carrying type; in the center we have three striking views of the airplane carrier, one taken from high in the air and another showing a plane taking off from the deck of the sled; the lower pictures show a plane riding on the sled and the act of putting the machine on the forward deck of the carrier

the water at high speeds. A considerable part of the shaft line was under water at all speeds and liable to serious damage from submerged obstructions, and, at the same time, shaft line and propellers could be readily fouled by weeds.

In an effort, first, to do away with shaft and appendage resistance, and, second, to develop a more satisfactory mechanical arrangement, Mr. Hickman lifted the propeller shafts to a position above the water line at the stern so that practically only the working portions of the propeller blades dipped in fast to "iron out" the water at the stern, and so permit of a strictly regulated dip for the propeller—the secret of success in surface-propeller installations. The first such boat had only 17 horse-power in a 20-foot hull, but with the first pair of propellers tried the boat made better than 18 miles per hour.

Here at once was a speed boat radically different from anything that had ever been afloat. There was no shaft under the bottom of the boat, and from end to end the bottom was clean of any projection with the exception of the water intake. The propeller shafts were held rigidly just above the bottom of the boat in a shaft log at the stern and ran in long lubricated bearings of ample surface instead of in small non-lubricated bearings held in a strut-arm under water. The propellers for a given power were so much larger in wetted area than screw propellers for similar power that they did not cavitate. The boat drew about half as much water as the screw-propeller boat of similar size and power, and, because the shafts were above water, the boat could run through heavy growths of weeds without the propellers fouling and with the speed practically unaffected. Also, in the case of running over a submerged obstruction, the worst that could happen would result in bent propeller blades, the shafts being protected from damage and of larger diameter than in the ordinary speed boat.

The steering system was next attacked, and side-plate rudders substituted for the ordinary type rudder. The side-plate rudder, instead of being hung at the stern and swung by a rudder stock, was hung at the sides of the boat aft, projecting beyond the tran-

(Continued on page 351)

Left: Cabin looking forward from the pilot's quarters. *Right:* Corridor and fuel tank. *Center:* Wireless operator and his equipment.

Views aboard the giant Farman "Goliath" biplane

Aboard a Giant Passenger-Carrying Airplane

IT is not because the Farman "Goliath" biplane is the largest or the finest or even the first of its kind that so much attention has been paid it by the press of the world. This airplane has been intelligently used by its builders, and its numerous flights with civilian and military passengers have attracted no end of writers and photographers.

The latest exploit of the Farman "Goliath," which has already been described in these columns, was in a recent flight to Dakar in Africa. Starting out from France, the big airplane with its load of military passengers winged its way toward the west coast of the Dark Continent. While the machine was flying along the coast at a point about 90 miles north of St. Louis, Senegal, the bolts securing the right propeller were sheared. For 35 minutes the flight was continued with the starboard engine running alone. This engine overheated, and it became necessary to land on a patch of sloping beach when the tide was high. The machine after landing ran into the sea and was badly damaged. The crew were alone for six days before parties of natives from neighboring villages discovered them. They had a limited quantity of food in their possession, and water was obtained by distilling sea water.

The accompanying illustrations taken aboard the Farman "Goliath" while in flight are the first to show the crew's quarters of this giant airplane. The first view shows the leg of the pilot at the left, with the map holder directly in front, as well as view of the cabin forward. The second view shows the corridor running alongside the huge gasoline tank, while the third shows the wireless installation.

Near view of the cabin of the all-metal German monoplane

Why Germans Are Flying for Business Rather Than for Fun

THE end of the war has given Germany a good opportunity for developing civil and commercial aviation, as a start did not have to be made with joy-riding. Owing to the total breakdown of the railways more than other things, aircraft have come to the fore as the speediest, the most certain, if not the safest means of transportation. The cost of aerial travelling cannot be helped for those who, perforce, have to travel, but most people are not travelling at all, owing to the present railway troubles. Should the re-establishment of the railways to something like normal conditions not bring the cost down to the earthbound regions soon, which does not seem possible, as the railroad inefficiency is owing to lack of materials, and as the locomotive output is less than ever, thanks to strikes, then aircraft may have chances of developing into pure commercial types, in spite of the otherwise sad financial situation.

At present G and C class airplanes are chiefly used, i. e., the twin-engined A.E.G. five-seaters, made by the German Air Shipping Co., and their modern two-seaters, made by the Sablatnig and Rumpler works. These are the three foremost enterprises, and have government license for passengers, mail and parcel aerial service.

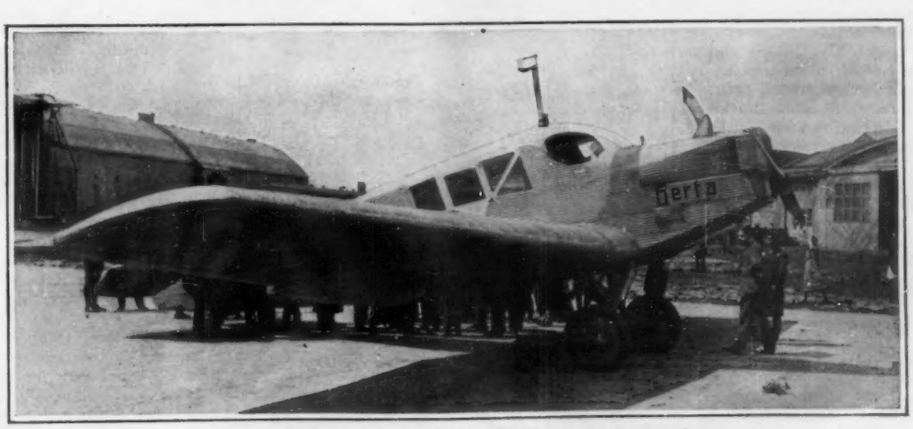
So far, services appear to have been successful, which means that delays have not been caused by technical or meteorological factors, but by strikes and the lack of petrol resulting from them. Thus the Deutsche Luftrederei has for some time only been able to maintain the main lines between Berlin and Weimar, and although it has acquired the former naval sheds at Aabenraa in Schleswig, it has been held up by fuel troubles. The Sablatnig Co. hopes to inaugurate a service from Schleswig to Copenhagen, though so far it has not the sanction of the Danish Government.

As they are the persons chiefly forced to travel these days the artists, actors and actresses are the best pioneers and advertisers of the various commercial aviation firms.

The Sablatnig enterprise employs its night-flying N model with good maneuvering capabilities. It is equipped with a 230 h.p. Benz engine, and has the front observer's cockpit transformed into an enclosed narrow cabin for four passengers, which makes the machine appear rather nose-heavy in landing. Various other aircraft works have adopted the Airco two-passenger limousine fashion fuselage for their modern light two-seater (C.L. class) biplanes, by raising the rear observer's cockpit. The D.F.W. works in Leipzig and the Hannoversche Waggonfabrik have done this.

Most other passenger-flying has been done with the Staaken giant type, which is now a combined tractor and pusher biplane with four engines in two interplane power-eggs. A regular week-end trip service, similar to the Farman-Goliath Paris-Brussels one, is run between Berlin and the seaside resort Swinemünde, and affords the wearied inhabitants of the capital some possibilities of fresh air. Both Staaken airplanes and seaplanes are employed with the fuselage nose made into a passenger cabin. One Staaken aircraft has with full passenger load crossed Mount Brocken, according to *The Aeroplane.*

Among the licensed builders of this well-employed type is the Aviatik works, now situated at Leipzig-Heiterblick. They manufacture for commercial, mail and passenger service a R.III model, with four 250 h.p. six-cyl. Benz motors. The main dimensions are: Span, 43½ meters; maximum length, 22½ m.; maximum height, 6½ m.; empty, weight, 9 tons; fuel and crew, 1,800 kg.; useful load, 1,800 kg.; total weight, 12,600 kg. The crew comprise: One captain, two pilots, two engineers, and one steward. The fuel capacity suffices for a 7 hours' flight, or a distance of 875 km. The speed is 125 kilometers per hour at an altitude of 7,500 ft., the climb being 10,500 ft. in 100 min.; 12,000 ft. is the ceiling.



German all-metal monoplane for passenger-carrying service

(Continued on page 354)

Red Rock Canyon

One of California's Unvisited Splendors to be Made Accessible by the Roosevelt Highway

By John L. Von Blon

UNTIL conditions made it impossible we flocked to foreign shores to see the sights and closed our eyes to the transcendent marvels of this Better Land. Now that we have been staying in our own we are also coming into our own and beginning to comprehend what we rejected. The past few years' travel here has served to demonstrate to those who formerly sought farther climes that the home scenery beats them all. And new features are constantly disclosed. We learn that we still are in the era of discovery, that exploration of the United States is far from complete. Instancing these statements, a petition was sent from the west a few days ago to the President to set apart Red Rock Canyon, in southern California, as a national monument. Who ever heard of the place?

This enchanted spot, rich in unique beauty and of peculiar scientific import, has just come to light—a neglected page in America's wonder-book turned. It is a romantic, rainbow-hued gorge containing a wealth of amazing structures reared and carved and even painted by the elements but comparable only to the classics of ancient and modern architecture. Its fossil beds, undug and unsearched, give promise of prehistoric treasure to science; archeologists and educators are concerned in finds in its caves.

The canyon is a gash in the lower end of the Sierra Nevada Mountains. Its mouth opens upon the northwestern edge of the Mohave Desert near the El Paso Range and twenty-four miles from Mojave. It is only 126 miles from Los Angeles and 158 from Bishop, the principal eastern California town. More than half a century ago prosaic pioneers passed that way and paid no heed to its vivid charm. Now it suddenly finds itself on a main trail of civilization and tens of thousands of tourists and others are beginning to admire it in rapture and astonishment. Through its length of fifteen miles extends the southern branch of the Roosevelt National Highway (formerly the Midland Trail), a transcontinental automobile route to San Francisco and Los Angeles, entering the Golden State centrally *via* Westgard Pass and turning north and south. California has designated the Red Rock division a main line of its highway system and within a year it will be paved through the canyon. The survey for this modern boulevard grazes some of the prodigies which the Government is petitioned to protect and preserve. This road leads to the Sequoia (proposed Roosevelt), General Grant and Yosemite National Parks along and across America's loftiest and most magnificent ranges.

It was my recent privilege to pass some time in this canyon, make a cursory examination, and name its more inspiring works. At the same time it came to the attention of leading civic, commercial, highway and auto organizations and men of the Pacific Coast with the result that the head of the nation was asked to proclaim it under the Federal wing. The accompanying photographs indicate whether or not it is worth while. That section which contains the major surprises embraces a little less than four square miles, is several miles removed from the desert, and lies at about 3,000 feet altitude. On approach from either direction a turn brings the walled-in miracles of form and color into sudden view—an entrancing picture: pillars and columns, plain and fluted and chased; pilasters and colonnades, tiny and titanic, tier upon tier, mile after mile, far skyward; arcades, corridors, balustrades; temples, castles, cathedrals, towers, domes, spires, sphinxes, gargoyles—all perfectly molded and exquisitely adorned by the Lord of Creation and untouched and unmarred by the blundering vandal, man; an acropolis, a buried city, and scores of other fancies become realities. Attempts at description seem futile.

Standing upon an eminence at the canyon's head is the Temple of the Sun, an impressive gray pile 125 feet high, with a series of terraced entrance-ways and partially crumbled walls forming an elliptical enclosure approximately 150 feet in diameter—an ideal amphitheater. Those who look upon this temple find difficulty in believing that it is not a ruin of human handiwork. Nearby, dominating the entire mystic region, rises massive Sentinel Tower, imposing rather than pretty. It is harder and much more substantial than its falling neighbor. Geologists say it probably has held its commanding bulk aloft for hundreds or thousands of centuries. The walls are pinkish grey and the ponderous lava cap a dark red; a fascinating contrast against the mellow blue of the California sky.

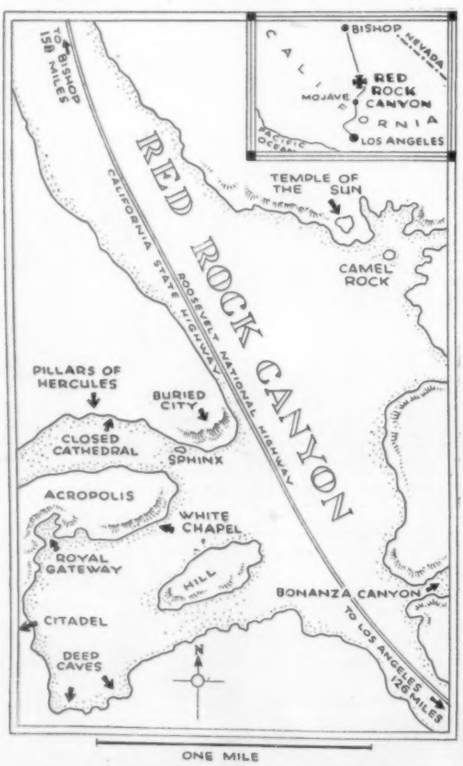
A mile diagonally opposite is The Acropolis, colossal and supreme; forbidding or inviting according to the sway of the beholder's emotions. More than 450 feet high, 1,000 long and solemnly aloof, it has been likened to the Athenian Acropolis and as well to the mammoth temple ruins of Baalbec, in northern Syria. It bears a remarked resemblance to the pile at Athens. Seen from any angle it is mysterious, awe-compelling, certain to leave a lasting imprint on the mind. Here is a standing invitation to troglodytes and cliff-dwellers

THE VIEWS ON THE OPPOSITE PAGE SHOW FEATURES OF RED ROCK CANYON, AS FOLLOWS:

1: The Royal Gateway, 200 feet in height, and leading to a sculptured foyer 600 feet deep. 2: The Great Temple of the Sun, containing an elliptical amphitheater 150 feet across. 3: Pan's Pipe-Organ, with pipes from eight to forty feet in height. 4: The Citadel, perched 400 feet up the hard, corrugated gray slope. 5: Indian Cave, where a priceless collection of pottery was found. 6: A bit of detail from the Buried City.

seeking new homes. In the days of the argonauts a band of desperadoes lived in secret chambers of The Acropolis and preyed upon the valuable metal freighting through from the Cerro Gordo mine at Owens Lake to San Pedro and tidewater, but there has been no occupancy since the notorious bandit, Tiburcia Vasquez, was driven out in the 70's.

A masterpiece is the Closed Cathedral, a study in magnificent coloring, so gorgeous and yet so softly harmonious that no mortal wielder of the brush dares hope to equal it. The edifice is of tremendous size with an entrance twenty-five feet high and fifteen wide, solidly blocked at a depth of twelve feet. Pure white, deep blue, yellow, red, green and all the intervening shades are blended in the decorative scheme. There is the suggestion of an immense stained-glass window. The whole aspect is of antiquity, enhanced by a crack or fault diagonally across the front and through the general formation—evidence of an earth slide before or possibly soon after the processes of erosion began. So realistic is the cathedral effect and atmosphere that one involuntarily listens for bells to intone the hour or call to prayers.



Map of Red Rock Canyon; the insert shows the general location

The Buried City, where masses of burned clay broken up like common bricks have crashed down and crushed and covered some of the best examples of natural construction, particularly a group of pagodas, is a somewhat melancholy sight reminiscent of Herculaneum and Pompeii. Fortunately there still remain several rare pagodas and a number of dainty sculptures, including a gracefully curved, lace-like parapet in the foreground. Here also may be seen other oriental building types which escaped the avalanche and bring to mind Thibet or Asia Minor. The Buried City occupies eight or ten acres. Above and behind it the walls loom 500 feet. The overwhelming blow came from the nether side of the top stratum. Enormous ledges continue to break off and go tearing down their destructive course. A section of a broken column rolling down like a log took the tripod from under the camera while these views were being taken, then landed in the highway.

Rising nearly 200 feet above the level floor in a deep pocket of the canyon is a stately columnar entrance of such symmetry and elegance and so beckoning that it unhesitatingly was christened the Royal Gateway. It leads to a sculptured foyer extending back 600 feet and having the characteristics of a superb art gallery in which almost any figure desired, heroic or miniature, may be discerned by giving the imagination slight leeway. In the center, at the correct distance from the opening, as though placed by measured design, stands a separate group of five columns on a tall base. Gateway and foyer are white as snow.

Four hundred feet up on the hard, corrugated gray slope, with the mountains for a background, is perched majestically a castellated palace, The Citadel. At a glance this is associated with impregnable Old World heights overlooking fertile vales or sapphire tides. It is a veritable castle of dreams among crags where bald eagles nest.

The gigantic Pillars of Hercules, dwarfing those of the Temple of Bacchus, symbolize enduring strength and seemingly defy time. Light gray and red, with supporting half-lengths at regular intervals, each with an ornate abacus, they appear to hold up the weight of the Sierra. A car readily can be driven directly to them.

The White Chapel is what the name implies. At the corners the walls are heavily buttressed, like the old Spanish missions of the Southwest. In general outline it resembles some of Mexico's ancient churches. Unlike them, however, it is elegantly embellished. There are many niches containing appropriate statuettes, though not reverently placed by padres. Digressing, it is worthy of note that Francisco Hermenegildo Garces, Franciscan and first of Europeans to gaze from the west upon that cosmic intaglio, the Grand Canyon of the Colorado, in 1775, was also the first white man to glimpse Red Rock Canyon. Records in the Santa Barbara Mission show that he journied the same year from Tucson to that part of California.

Another of the many curiosities is the Sphinx, a salmon-tinted leaning rock weighing more than a thousand tons, with detached base and capstone of dark red. It is distinctively Egyptian in design and faces the noonday sun.

Red Rock Canyon—so named because that color predominates—was from all indications a swamp teeming with fauna in the late Tertiary period; perhaps the only drinking-place in an extensive territory. Today it is a fossil field which undoubtedly will yield abundantly to expert exploration. Superficial inspection lately has disclosed remains of land mammalia all about—camels, horses, elephants, mastodons and numerous smaller species. These are imbedded in clay and shale throughout the canyon. Any temple may produce the everlasting skeleton of an extinct monster. At the base of the Temple of the Sun William Mulholland, chief engineer of the Los Angeles Aqueduct, picked up the petrified heel-bone of the largest saber-tooth tiger ever found in the Western Hemisphere. It was classified and its remarkable size commented on by the Smithsonian Institution and now is in the Exposition Park Museum, Los Angeles. This is the

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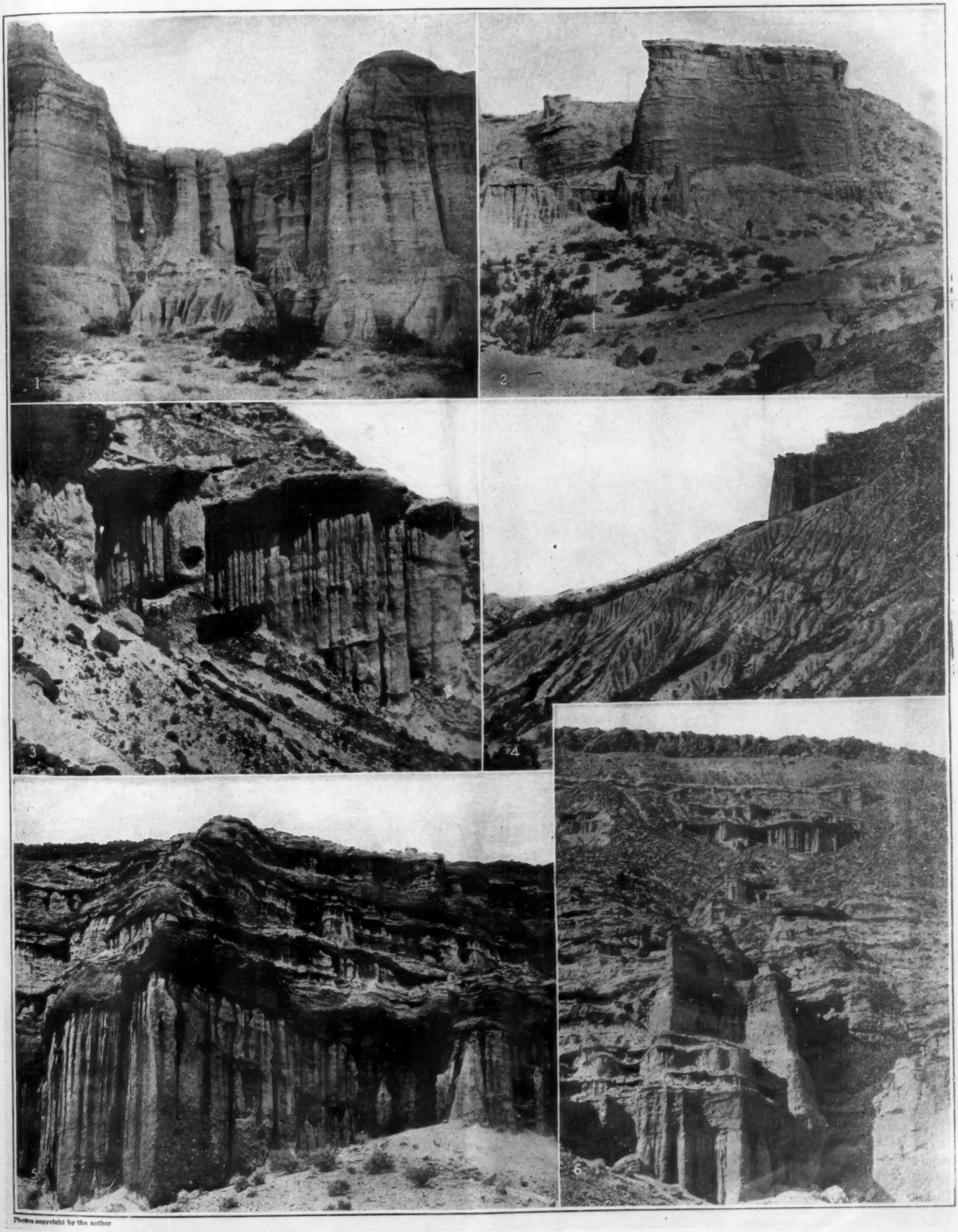


Photos copyright by the author

LYNITE

The Part that LYNITE Plays

What is the part that *Lynite* plays in making motor-car and motor-truck more flexible and easier to handle, more quiet-running, more economical of gasoline and tires?

Yesterday this question might have been answered by saying that in the past five years *Lynite* has directly cut more than two hundred million pounds from the products of the automotive industries—

That it has been used in seventy or more different parts, including practically the whole external structure of the engine—

That it has been widely accepted as the standard metal for pistons, where not only its lightness but its heat-conductivity is a decided advantage—

That it has made possible vast indirect weight-savings in supporting parts such as frames, springs and axles, and because of *Lynite* Pistons, effected further indirect gains in rotating and reciprocating parts, such as crankshaft and connecting-rods.

Now, however, the part *Lynite* plays can no longer be measured by the gauge of yesterday.

A new *Lynite* alloy has made it still more important and far-reaching.

For this new alloy takes *Lynite* into the field of *unsprung* weight—into that part of car and truck in which saving one pound is worth as much as saving anywhere from five to ten pounds above the springs.

Here where every bit of load is *dead* load—where there is nothing to cushion the repeated blow upon blow of heavy axles on springs, gears, bearings and other units—*Lynite* now eliminates **at least** half of the weight in such important places as axle housings, differential carriers and other parts.

Moreover, just as above the springs it has made possible great weight economies not only directly but also indirectly, below the springs it means similar gains in axle shafts, wheels, bearings and elsewhere.

This latest *Lynite* alloy, therefore, brings new opportunities to the door of the automotive engineer and new benefits to the car and truck owner.

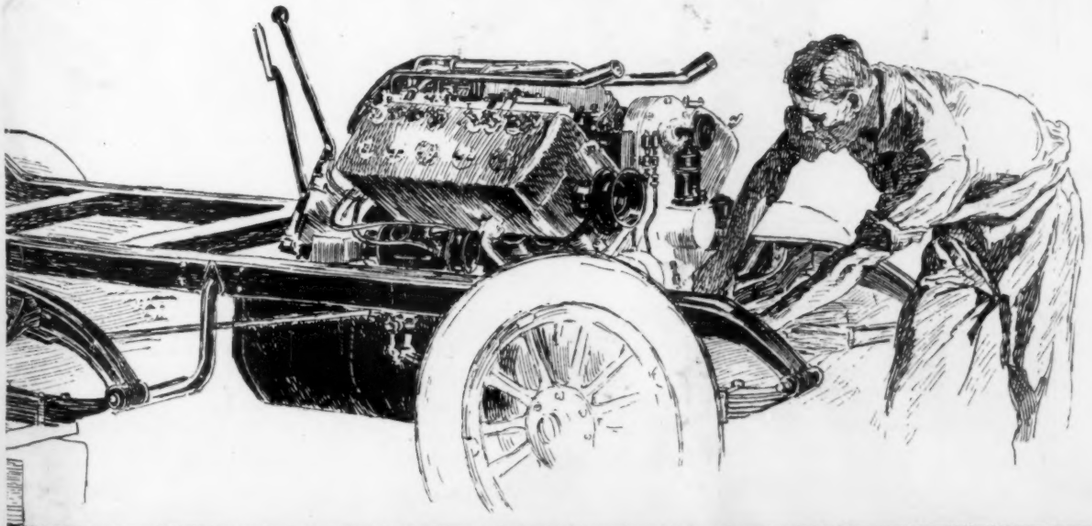
Such is the part that *Lynite* plays today, while *Lynite* Laboratories bend their energies to making it even more essential.

THE ALUMINUM CASTINGS COMPANY

LYNITE and LYNUX Products

Plants in

Cleveland Detroit Buffalo Fairfield, Conn.



LYNITE

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

The Concrete Pole-Base

THE wooden pole is poorly adapted for direct setting in the ground due to the action of the air and moisture at the ground level, which cause rotting at this point. It is also subject to destruction by fungus and insects, especially in some climates. Treatment of the pole butts by the use of antiseptic preservatives decreases the rate of decay, but is not a real preventive. Ninety-five per cent of all wooden poles are put out of commission by decay alone, without assistance from other factors.

The iron pole is subject to rusting at and below the ground level; in addition it is expensive and unsatisfactory to install and maintain, due to the requirement of special tools, special pole-line hardware, etc. It is hard to climb and dangerous to linemen because of its conductivity.

The all-concrete pole is unsatisfactory in many respects, being expensive, requiring special pole-line hardware again, and also special equipment for manufacturing, handling, installing and maintaining. It is too heavy to transport and erect with unskilled labor and simple apparatus.

A Rochester man has accordingly come forward with an invention designed to retain the best from the three types of poles considered above, and to reject each where its disadvantages are active. His pole comprises a wooden shaft, a concrete base, and an iron socket for union between the two. It is perhaps not superfluous to say that the concrete base is reinforced. In this combination he secures the benefits of the lightness and strength of the wooden shaft, with its ease of climbing, of working and of shaping and its valuable insulating properties. At the same time he gets all the advantages of concrete construction at and below the ground level. He thus disposes of the weight at the proper point and provides a rigid, non-corrosive and non-rotting material at the ground surface. The iron socket not merely forms the socket for the wooden shaft, but constitutes a good part of the necessary reinforcement for the concrete base. This base is set in the ground for a depth of about five feet, and projects for a foot and a half. It thus holds the wooden pole well above the ground level.

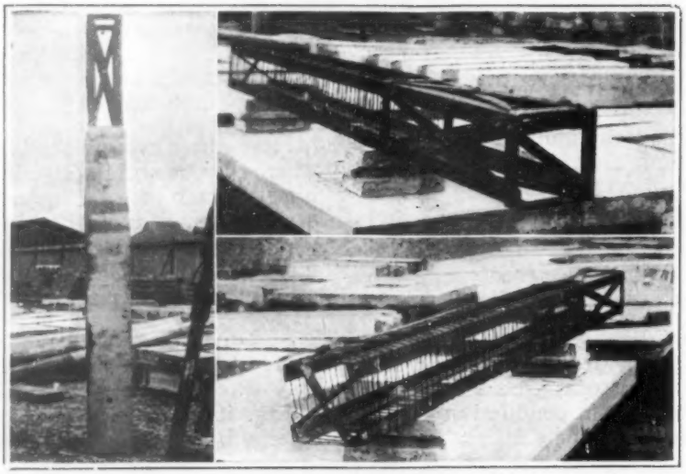
Great emphasis is laid upon the ease with which the new base may be installed under old poles. The wooden pole in service can be cut off above the ground and supported by a temporary structure while the concrete base is being planted under it.—*W. Roy McCann.*

A Novel Mortising Machine

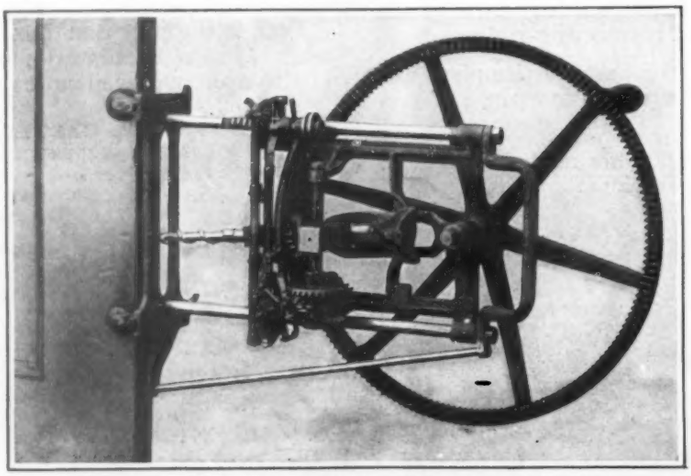
THE accompanying illustration shows a mortising machine, developed at Columbus, Ohio. It is claimed that this mortising machine will make a perfect mortise ready for a lock or tenon in three minutes without the use of a brace and bit or chisel. In order to operate the device, it is only necessary to clamp the mortiser on the door or piece to be mortised, adjust the trip pins for the mortise wanted, and note the graduation marks on the bar that carries the pins. The operator then throws the spiral feed into engagement with teeth on upper guide rod and then turns the crank a few times.

This labor saving device is designed to make mortises for door locks, screen door work, sash and cabinet work, or any mortise from 1½ inch to 6 inches long, any depth to 3¾ inches with all size bits ¼ to 1 inch and will clamp on anything ½ to 3 inches thick. It makes a complete mortise without moving the machine after it is set. That is done by the bit having an oscillating movement up and down.

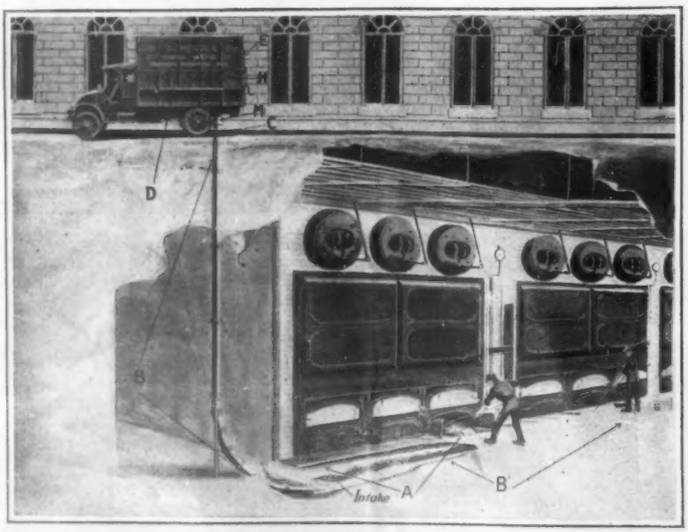
The automatic features are of interest as turning the main gear runs the bit at a high speed and turns the oscillating screw that carries the bit up and down through the mortise. The rotation of the oscillating screw is reversed at any point automatically by the bit arm striking a pin at top and bottom of the movement. These pins are moved together or apart by turning one thumb nut at top of mortiser, thereby changing the length of mortise as desired. The movement of bar that carries these pins imparts a rotation movement to the feed spiral and causes the bit to be fed forward into the wood at top and bottom of mortise. The screw carries the bit at the same speed in both directions firm and strong. The clamp is set by one thumb nut to each pair of jaws on right hand side, and automatically lines the mortiser perfectly with the work.—*F. C. Perkins.*



The concrete pole-base standing on the ground awaiting lowering into the hole; and two views showing the assembly of the concrete base with the metal socket, and the arrangement of the reinforcement



Machine designed to cut the mortise for a lock or tenon without brace and bit or chisel



Pneumatic system for ash removal

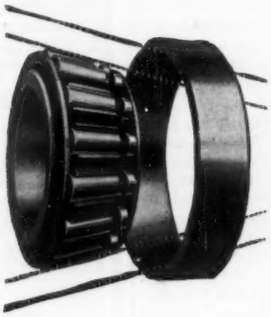
The Pneumatic Ash Can

THE accompanying illustration shows a novel system of pneumatic ash conveying recently placed in operation in various boiler plants in New York city and elsewhere. In each of these installations there is a concrete pit, equal in length to the front of the boiler, as shown at *A* in the photograph. This pit is covered with a sectional sheet-iron cover, making it possible to uncover any section of pit. *B* and *B'* indicate an eight-inch conveyor line extending from beneath the concrete pit to, and terminating under, the sidewalk at the curb. At convenient points in the pit, ash intakes are inserted in conveyor line. These intakes extend through the pit and flush with its bottom.

The apparatus above mentioned constitutes the only equipment required to be installed on the premises and represents the only investment necessary for the owner of the building. The conveyor truck *D* consists essentially of a 6-ton chassis, equipped with a high-pressure blower driven by truck motor, a washing device for eliminating all dust from air before exhausting into the atmosphere, a silencer, and a steel bin or separator *E*, placed above the machinery and forming body of truck. The ashes are discharged from the bin by means of the gates *H*, raised through racks and pinions on a shaft extending entire length of bin. The shaft is revolved by means of a crank at rear end. The conveyor truck connects with the terminus of the conveyor line *C* at the curb by means of an extension pipe *M*, hung on a rocker joint allowing ample flexibility for alinement in making connection.

In the operation of the system the ashes are raked from boilers into concrete pit by the fireman. Upon arrival of the conveyor truck, the operator makes the necessary connection to the conveyor line and starts the machinery on the conveyor truck. An assistant operator enters the boiler room for the purpose of feeding the line. When all the ashes have been removed, the operator disconnects the conveyor truck at the curb and discharges the ashes from the bin on the conveyor truck into a dump truck by gravity, through the gates provided. The dump truck then proceeds to the point of disposal, allowing the conveyor truck to go to the next building to repeat the process.

TIMKEN TAPER



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Every one of the more than four hundred automatics on our floors is there because it does its part day after day in support of those principles.

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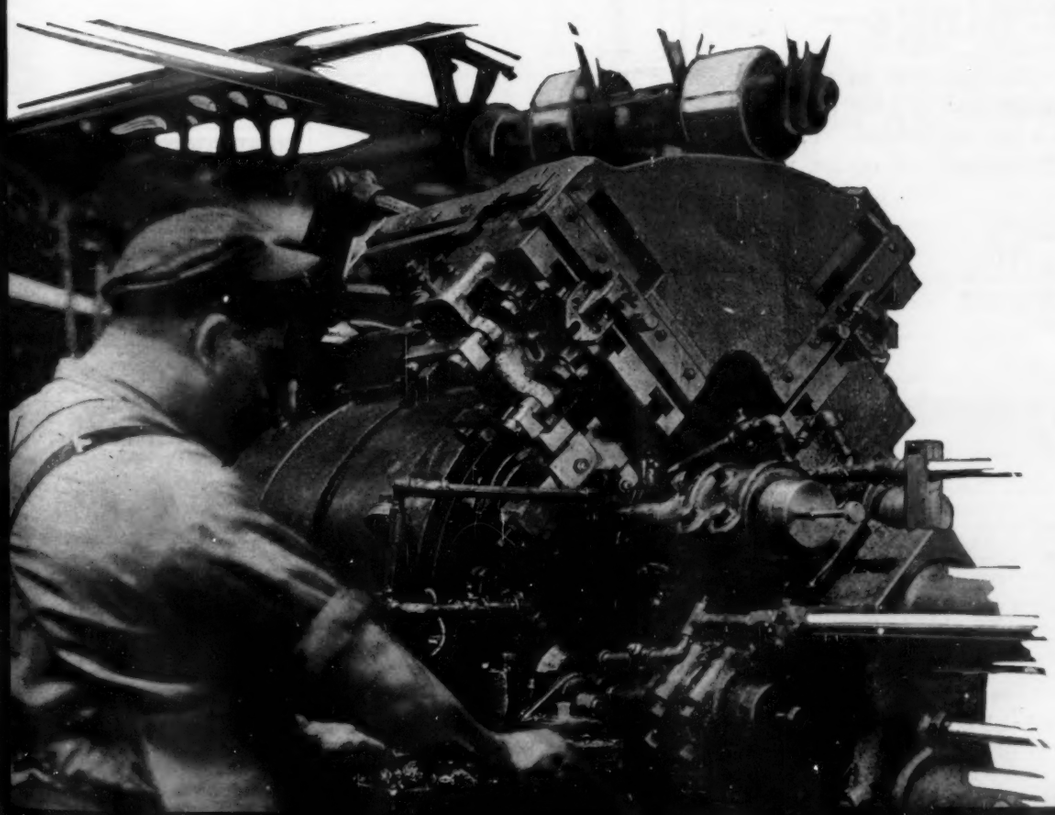

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The Current Supplement

THERE has appeared recently in one of our prominent scientific journals a very long article presenting in considerable detail the evidence for a new and very ingenious theory of the nature of atoms, molecules and matter. The article is so long and detailed and on such a recondite subject that it seemed wiser to present an introductory interpretation of this new theory by Dr. I. Langmuir, and such a contribution is found in the article *The Langmuir Postulates*, which sets forth clearly and simply the fundamental postulates as to the nature of matter and serves as an introductory guide to the new theory. This introduction will be found in the SCIENTIFIC AMERICAN SUPPLEMENT for October 4, 1919, being issue No. 2283. The same issue contains an interesting illustrated discussion, from the French on *Vegetable Plethora*, which discusses the effect of over-feeding and under-feeding, respectively, on the development of sexes in the plants affected. The recent papers on the electric furnace find here also a supplemental essay which touches on *Internal Actions and the Performance of the Electric Furnace*, particularly discussing short-circuiting, etc., within the furnace due to redistribution of contained materials. A full-page illustration presents in a most graphic manner an interesting record of the effects of the eruption of Kalut Volcano in Java last May; and a very well illustrated paper on *Testing Rifle Ammunition* sets forth the machinery used for the tests necessary to maintain a proper standard of perfection in fixed ammunition.

The second half of the interesting paper *Prime Mover of Great Economy* dealing with Still's new engine, accompanies the second illustrated contribution on *Fingerprints*. In the latter article the author discusses the manner in which invisible impressions with different substances may be revealed and discriminated, particularly by means of chemicals and by the application of heat. A number of interesting illustrations, recently released by the United States Government set forth the process of securing materials for topographic maps by means of airplane photography and serve to illustrate a recent address on *Airplane Mapping of the United States*. A long but valuable discussion from an eminent English mathematical astro-physicist discusses the *Present Position of the Nebular Hypothesis* and concludes that while the famous hypothesis was poorly conceived to explain what is author had in mind, yet it served as a valuable tool for fruitful research and proves to be the best modern hypothesis for a number of phenomena of which its author was necessarily ignorant.

The Romance of Invention

(Continued from page 340)

thing else—for instance, a machine gun.

So there is little left of the original in the development of 1919. One thing remains. . . the Wrights always contended that the biplane was the effective construction and this the flying world has proven.

It is a far cry from Orville Wright's first ten-mile flight, from Ft. Myer to Alexandria, Va., and return with Lieutenant (now General) Foulois as a passenger, to the non-stop cross-Atlantic flight. It is an even further distance from the first tentative patents. . . the most admiring estimate of the genius of the Wrights can hardly accord the patent a much stronger adjective. . . to the hundreds, even the thousands of patents which cover the art today.

There are three thousand and twenty-eight patents on aeronautical devices in the United States Patent Office. These include launching and landing devices, balloons and parachutes, flying machines,

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contains Patent Office Notes. Decisions of interest to inventors—and particulars of recently patented inventions.

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kites, propellers, steering gears, cars and miscellaneous details. On flying machines proper there are over 1,200 patents, mostly subsequent to the Wright patents, but a fairly numerous class antedating them. Early patents on matters aeronautical are matters for present day humor rather than serious consideration, many having been granted on devices which never did and never could fly.

On the 1,233 patents at present issued rests the industry of today. At the time of the armistice, America had a quarter of a million workmen engaged in airplane and motor construction.

Just what she will do with this industry is a question which presses for answer. Just how much of it may remain to fill a peace time demand no one can say. But several of the greater factories have indicated their intention to stick to the game, believing that the conquest of the air has only begun and that the future holds commercial, pleasure and business flying as well as war and experimental flying.

To Orville Wright it must be a source of gratification beyond the power of most of us to conceive, to see what the invention which he and his brother gave to the world has accomplished. No one would be quicker than Wright to deny that all the credit was his, or to give to Langley, Chanute, Montgomery, Lilienthal and others, the credit for the work they did which should be theirs. But the Wright invention and the Wright patent are unquestionably the foundation of modern aviation. Before the Wrights, men did not fly. Since they showed the way, man has progressed enormously in his conquest of the last unconquered element. Less than ten years have passed since the world acclaimed a ten-mile non-stop cross-country flight. Still less since it gasped at the flight over the English Channel. And now they fly the ocean.

So whatever else may or may not be said of the two men who had the courage to face ridicule until they were ready to show results, who had the nerve to fly where men had never flown before, and to prove to an incredulous world what that same world did not believe could be proved, the fact remains. . . they flew, their invention worked, their patent founded an industry and an art, none the less that machines are no longer made according to its specifications and that there is little in common between the first Wright machine and those of today save the one fundamental—flight.

The Sea Sled

(*Continued from page 342*)

som and pushed from the after end by a push rod operated by rack and pinion. This made a positive type of steering device of low resistance. Following these radical changes in propulsion system and steering gear, the conventional boat type hull with wedge-type bow and convex bottom sections was next to be dealt with. The normal type boat, when driven at high speed, yawed in a following sea, pounded in a head sea, was unstable in a beam sea and was exceedingly wet in any weather; so, in this audacious development, she was revolutionized. The bottom was made of inverted V-sections instead of convex or V-section. Water lines forward were made outcurving away from the keel instead of incurving toward the keel, the top sides were made parallel instead of incurving and the boat was wider at the bow than at the stern. There was nothing left of the speed boat as formerly understood except the accidental resemblance of a vessel more or less open on top.

This anomaly was fitted with surface propellers and side-plate rudders and became the sea sled. Instead of throwing spray out at the sides, the boat gathered it in and sat on it and formed an air cushion under her bottom which prevent-

They'd have to be Acrobats to compete with ECONOMY

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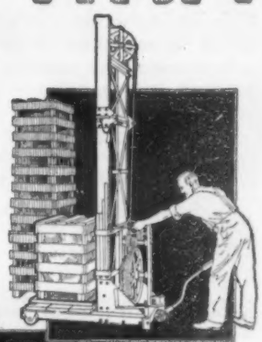

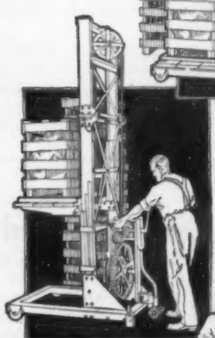

Above—Moving machine into place beside pile

Center—Elevating load

Below—Unloading

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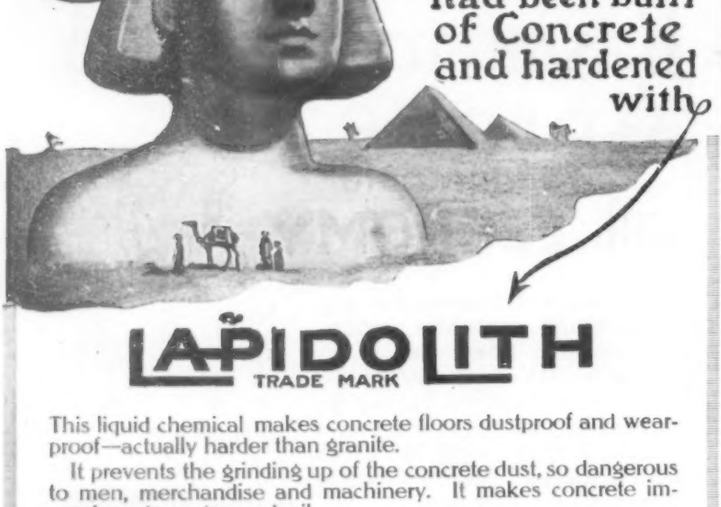

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ed pounding. Her water lines were such that she automatically righted herself in rough water, and the tendency to yaw and capsize shown by earlier speed boats was done away with. Because of the parallel sides forward, with all spray thrown underneath, the boat was extremely dry, and altogether it became evident that a new era in sea travel had been made possible. Here was a craft that could be taken out and driven at the highest speeds in the open ocean without the danger of capsizing and without discomfort to the passengers.

The first descriptions of the sea sled were published very shortly before the war, and the first boats were demonstrated to the United States Navy Department by Mr. Hickman at Boston. At this time the sea sled had only been built in the 20-foot size. The first sea sled ordered by the Navy Department was a 24-foot boat, fitted with twin 75-horse-power engines and used as a rescue boat and tender to seaplanes at one of the naval air stations. The boat gave such a remarkable performance that the Navy Department asked for a larger sea sled and the 30-foot model was designed, the first boats of this size being fitted with 8-cylinder engines. The 24-foot sled had shown a speed of about 32 knots, and the 32-foot sea sled, while 32 knots was at first guaranteed, has finally developed maximum speeds of about 38 knots. The Navy Department now has in service a fleet of between 30 and 40 of the 32-foot sea sleds alone.

One example illustrating the seaworthiness of the 32-foot sea sled may be cited. Two of these boats left Boston one day in the summer of 1918 to make the run to Bay Shore, Long Island, a distance of 226 nautical miles. They had to face a stiff head wind throughout the trip which at Pt. Judith showed a strength of 30 miles, the water at times being very rough. The trip was made in an actual running time of 8 hours and 5 minutes, or at an average speed of 32 statute miles per hour or 28.49 knots. This must be looked upon as an extraordinary record, considering the conditions and the relatively small size of the boats, and gives a fair basis for judging the possible use of sea sleds for high-speed transportation on water in very much the same way as motor cars are used on land.

After the United States entered the war, a 50-foot torpedo-carrying sea sled was called for and built, entirely as an experiment. Aside from the torpedo-carrying feature, its size turned out to be so eminently practicable that the idea was at once suggested of building, on the same general lines, sleds which should be capable of carrying seaplanes, the sled to be designed to develop sufficient speed to enable the plane to take off without a run on being released from the boat. A number of the advantages of this proposal were obvious.

The land plane at once became more seaworthy than the seaplane and could get away under worse weather conditions than could the seaplane. Once in the air, there were no pontoons or boat body to be carried, and the weight saved could be replaced by bombs, passengers, fuel or other useful load. Planes operating over water would have the fighting and maneuvering ability of the land plane instead of the limited maneuvering power of the flying boat or of the seaplane with pontoons.

Preliminary trials, without airplanes mounted, were carried out at Boston, the boats showing speeds in excess of 50 miles per hour. The sleds were then taken to the Naval Air Station at Hampton Roads where first a 3-engine, 600-horse-power Caproni land machine was mounted on one of them and later a Curtiss JN type.

The Curtiss machine was the first to be flown from the sea sled, the speed of the sled being so high that the plane went up almost vertically above her on being released. The first trial was most successful and without incident.

What the maximum speed of these airplane-carrying sea sleds may be is known only to the Navy Department. They are, however, fine examples of heavy boats driven by high power and attaining extremely high speeds. The four engines drive four independent surface propellers and the maximum power available is probably between 1,700 and 1,800.

The development of these high-power high-speed sea sleds for military purposes, while perhaps not of direct commercial interest, has had an important bearing on the development of the sea sled type boat as a whole. The data acquired has been of the utmost value. The war may be said to have done for the sea sled what it did for the airplane—given the basic data for an extended commercial development.

Since the armistice a number of engineering firms in the United States, feeling the uncertainty of the airplane engine market for the present, have turned to the development of high-grade, high-speed marine motors based in many respects on airplane engine design and adapted for use in sea sleds. The production of such motors should give a strong impetus to the adoption of high-speed sea sleds for general marine automobile service, the boats at high speeds apparently being at least as safe and comfortable as the motor car at similar speeds.

Within the past three months, Mr. Hickman has been carrying out a series of experiments in the development of a displacement type surface propeller boat with a hull having all the essential characteristics of the high-speed planing sea sleds. The experiments, so far as they have gone, have proved successful and the boats, aside from their peculiarities of shoal draught and weedlessness, have shown great stability and dryness.

This development opens up a novel vista: If the planing sea sled is the successful high-speed boat, and the non-planing sea sled already apparently develops certain advantages in comfort and in construction over other low speed boats, just where may the boundary of sea sled development be placed?

The least that can be said is that, considering how radical were the changes introduced into boat-building, one of the most conservative of the arts, and considering the briefness of the whole development, the sea sled and the surface propeller have made noteworthy progress.

Red Rock Canyon

(*Continued from page 344*)

great "springing-bone" of the tiger. The specimen is four and a half inches long.

The canyon walls are indented by caves and caverns, some a hundred feet in depth. In one of these a member of a passing surveying party discovered a collection of Indian pottery worth thousands of dollars. It consisted of forty pieces, placed in orderly fashion along the walls, and covered five to ten inches with dust. Had they been selected by a professor of archeology for his own use the choice and arrangement could not have been improved upon. Most of the pieces are delicately shaped, very thin and nothing less than glazed, with bright pigments applied before burning. Originally this was a part of the region occupied by the Piutes, Shoshones and related tribes but the pottery from the cave is infinitely superior to any of their known craftsmanship and its source a mystery. None like it has come to light elsewhere.

The Red Rock formation consists in the main of volcanic mud, primarily pale pink, and composed of clays, gravelly sands, silica and a cement-like binder that imparts to the combination some of the qualities of concrete. Volcanic action and terrific heat are the agencies

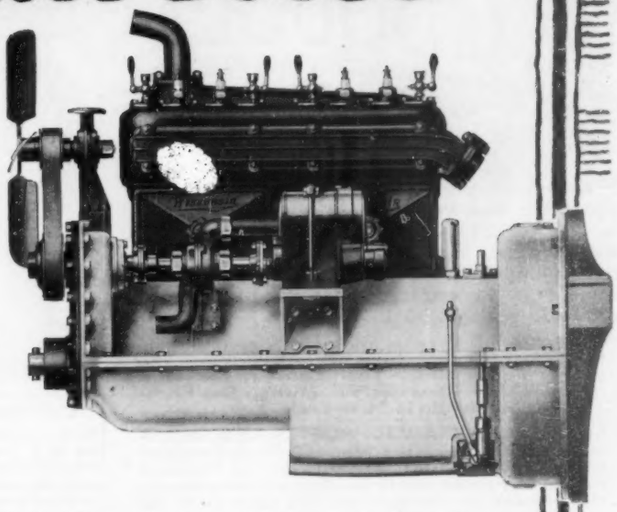
responsible for the lava strata, cappings and battlements, and the startling color effects. The canyon is treeless save here and there a group of scraggy yuccas—the grotesque Joshua trees. An occasional patch of greasewood or clump of silvery sage adds tone and fragrance. In the spring the lower area is a glorious sheet of wild bloom, gold and blue and white, relieved by dashing scarlet splotches of Indian paint brushes or the rare magenta Mariposa tulips. Millions of baby-blue-eyes open wide in wonderment at the strange grandeur above and around them. Most of the year it is waterless, but one or two feeble rivulets surviving the long dry season. Frequently in midsummer huge black thunderheads—Thor's bombing planes—come roaring and booming up from the Mohave's appalling heat blasts and cloudbursts loose their gushing cargoes. It is not unusual for a yellow freshet several hundred feet wide to form in a few minutes and rush down the canyon for hours. In time of torrential rains and when wild winds whip the grinding sands about, the elemental forces do most of the quaint fabricating of the make-believe edifices they ultimately raze. Winter brings snow-flurries, but on the whole the canyon always is pleasant climatically, and easily accessible. The Southern Pacific Railroad delivers passengers within a few miles. Abundant water would be available to the Government from the Los Angeles Aqueduct, which crosses three miles above the Temple of the Sun.

The romance of gold weaves its irresistible spell about this august precinct. Hundreds of thousands of dollars has been taken from the dry placer diggings of the clean sand bottom. Old prospectors, lured by the eternal hope of an undiscovered mother lode opulent as Ophir, still linger there and seek the source of the yellow bits that every mountain flood washes down. Under cross-marked mounds by the roadside, where lupines blow and desert primroses nod to the evening star, sleep men of forgotten names who were in the same quest long ago and found peace if not fortune. Three years since in Bonanza Canyon, a small branch of Red Rock opposite The Acropolis, a lucky hunter flushed a nugget worth $600. Miners have burrowed far beneath the cliffs to garner the precious dust. Close at hand is Goller Mountain, so named for a famous lost mine, one of the few ever found again. This is historic by reason of a $1,000 nugget which lay on the surface.

I had been in the canyon all day but decided to remain when evening came on. Then, indeed, every minute proved a revelation. As the sun sank low and the shadows of the long, gaunt arms of the Joshuas stretched farther and farther, the soft haze peculiar to that arid country enveloped the scene like a purple silken veil. It was a magical panorama but for a short period only. The curtain of darkness fell almost simultaneously with sunset. This is a land of brief twilight. An hour later the moon rose and wrought another thrilling transformation. The spectral city was sublime in its calm loveliness, weird in its silence and solitude. Without strain on fancy I conjured up the gods and heroes and elves requisite to complete the poem and watched their revels and incantations. My reverie was broken by a piercing cry that rang out through the night stillness. It was the wailing bay of a coyote. A hideous chorus of answering barks came from other hungry gray beasts. I drove away and out upon the commonplace, the Mohave, and inscrutable desolation. Memory always will retain the picture.

Red Rock Canyon, uninhabited and wellnigh unknown, is public domain with the exception of a private claim or two. The highway and its inseparable companion, the automobile, are opening it unreservedly. It is a matchless monument

Costs Less at the Higher Price



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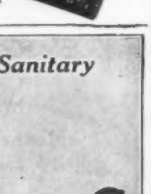

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Why Germans Are Flying for Business Rather Than for Fun

(*Continued from page 343*)

Most interesting of all, perhaps, is the all-metal monoplane shown in the accompanying views. This is undoubtedly a Junker machine, very much like those used during the closing months of the war by the Germans. In the absence of definite information, it appears that this machine is made entirely of sheet aluminum, suitably corrugated to give it great strength. The post, which extends over the cabin, carries a speed tube and drift indicator. The pilot sits up forward in the open cockpit, while the passengers are properly protected. All in all, this machine represents a big step forward in commercial flying, so far as design is concerned; but it would be interesting to hear what the performance of the machine is before passing on its practicability. Heretofore all-metal planes have not proved very successful, and for that reason builders have had to keep to wooden construction through necessity rather than choice.

X-Ray Photographs of Plants and Their Parts

THE use of X-rays for revealing the inner secrets of the structure of the bodies of men and animals has long been familiar, but their application to the plant world is more recent. The manner in which this is done was described by Dr. H. Rieder, in "Umschau" in 1916. An abstract of this article has just reached this country in a copy of the *Neuste Erfindungen und Erfahrungen*, from which we take the more important features. The author points out that great differences exist between the different parts of a plant (root, stalk, leaf, flower, fruit and seed) with respect to their content of mineral ash and consequently with respect to their power of absorption for Roentgen rays. The numerous mineral constituents of plants all appear clearly in the X-ray picture and the fact that even the most delicate structures of plants can be thus photographed bears witness that even those bodies which are apparently transparent to X-rays do absorb them to a certain degree which is governed by their consistence and thickness, their content of air and of sap, and their chemical constitution. Like other objects plants appear upon the photographic plate not as mere shadow pictures but in so-called "plastic" representations, *i. e.* giving an effect of three dimensions. Only the long waves of the X-rays can be employed to photograph vegetable structures, *i. e.* those which either come from a tube exhausted to a very low degree, or else a tube fitted with so-called Lindemann glass which is also quite tranpsarent for rays of very great wave lengths. In this kind of glass those constituents of ordinary glass which have a comparatively high molecular weight, such as sodium, calcium and silicon are replaced by constituents having a lower molecular weight, *i. e.* by lithium, beryllium and boron.

The method of taking these pictures is as follows: The photographic plates in boxes are cut out of thin black paper upon which the single plants are laid out as flat as possible and then illuminated after which the plates are developed. Dr. Rieder mentions a series of plants which are peculiarly suitable for representation by X-rays; these include garden plants of luxuriant growth, tropical plants, the larger fungi, the phanerogans, in which the bundles of fibers of the ribs, veins, and stalks are especially distinct, or where the air filled spaces in stalks and stems or the seed pod and seeds are very distinct from tissues transparent to the rays.

Like other bodies different kinds of wood absorb X-rays to a certain degree and the different varieties can be easily recognized in these pictures by the structure and course of the fibers as distinct from the surrounding tissues. The hard wood at the core can be readily distinguished from the outer sap wood by its greater density. The separate annual rings are clearly shown also through their concentric lines. The more delicate details of plant tissues are, of course, not revealed as in the microscope. The processes of nutrition and the fertilization of the plants can also be studied with ease. A great advantage of this process, of course, is that it avoids the necessity of tearing the plant to pieces in order to study it. The author also suggests that these novel pictures are capable of yielding many suggestions to the artist and the designer of textiles, wall paper, etc.—*M. Tevis.*

Condition of the Port of Ostend

BEFORE the war this summer resort had a population of about 60,000, the larger part of whom depended upon the summer visitors for a living. A large number of the former population have returned to their homes and preparation is being made for the coming season. There is very little work for the population except in restoration, which is as yet proceeding slowly, and in fishing. The latter is proving a very lucrative work just at present owing to the high price of fish and the large catches. Fishermen with single boats (30 feet in length) have made a profit of 5,000 francs in one week.

The port of Ostend consists of two ports, the old port and the new port. The former includes the entrance channel, the fore harbor, the anchorage basin for fishing sloops, the three commercial basins, and the basin on the east bank of the channel, where Belgian government packets are docked while undergoing repairs. The new port, connecting with the old, comprises the maritime extensions of the port of Ostend. It includes the landing quay of the Dover-Ostend packets, the new fore harbor, the turning basing, the wet dock, and the canal basin. The new fore harbor, with an average depth of 26 feet at low tide, is especially adapted to regular navigation. It is crossed by a drawbridge which divides it into two navigable passages 50 feet wide.

The wet dock for commercial ships of other than regular service is 2,000 feet long and 280 feet wide. The entrance to this dock is a lock 56 feet wide and 372 feet long, floor 14 feet below the level of low tide. With this are connected the canal basin and the turning basin, which are used especially for the importation of lumber from Russia and Scandinavia. Two anchorage basins on the east bank, one behind the channel, the second above the new fore harbor, prevent the port from silting up. Access to the port from the sea is assured by three navigable dredged passages, depth 19 feet at low tide.

Ostend is connected by navigable canals with the interior by means of the Bruges-Ostend Canal. Two important railroads at Ostend connect through Ghent and Brussels with Germany, and through Flanders with France. Three packet lines formerly connected Ostend with England, one to Dover, one to London, and one to Tilbury. The Dover line, which was the principal one, operated 11 fast packets and carried in the year 1911 over 181,000 passengers.

The destruction at the port consists largely of ruined bridges and sunken vessels. A half dozen of the largest bridges across the various canals of the basins have been entirely destroyed, as well as the principal bridges on railroad lines south from Ostend. In the harbor itself a number of sunken vessels—Belgian commercial steamers, dredges, barges, and sailing craft obstruct the channels. Through neglect the channel of the entrance into the harbor has become much shallower,

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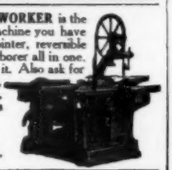

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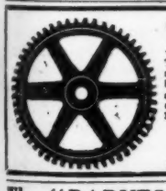

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owing to deposits of mud. English companies are now engaged in removing these obstructions and in dredging the channel entrance, since the only Belgian dredge at Ostend was sunk in the entrance to the harbor. It is now being raised by an English company.

The "Vindictive," which was sunk directly across the entrance to the harbor, has now been moved so that it lies alongside the western pier. The channel entrance is about 400 feet wide, and now permits easy access across to the inner harbor. There are three English dredges at work clearing away accumulations outside of the channel entrance.

In general, the cranes and harbor facilities at Ostend have not been systematically wrecked as at Zeebrugge. Ostend can resume commercial activity in a few weeks, though complete restoration will require months. The entire surroundings have been changed until they have the appearance of a vast fort. Batteries of guns were located at advantageous points for defense, miles of barbed wire have been stretched along the sea walls, and all land approaches to the harbor entrance were made inaccessible in some way.

Benzol as Fuel for Gasoline Engines

IN England where gasoline sold for 5 cents a gallon in normal times or 100 per cent more than the average price in this country, engineers have sought to use benzol, which is said to be adaptable to the present type of motors without change, and in cases where it has been used, as much power is obtained as with gasoline. This material is a by-product incidental to the manufacture of illuminating gas and coke, and while it was formerly distilled from coal-tar and obtained only in small quantities, improved methods make it possible to produce about three gallons from every ton of coal changed into coke or gas. The former material was at one time produced by a process which permitted the gas to escape, but at the present time this is retained and condensed to form benzol. The crude product is a foul-smelling liquid which has about the same consistency and color as heavy ale. When subjected to a refining process the dirty liquid is converted to one that is about the same color as water.

Benzol is not as volatile as gasoline but it is claimed that a motor may be started without difficulty with this fuel supplied to a carbureter of ordinary construction. Owing to the greater number of heat units it contains, it is said it will develop more power than gasoline, and as it will not evaporate so readily it does not become stale or heavy so soon by the vaporization of the lighter fractional constituents. A disadvantage incidental to its use has been that owing to it being richer in carbon than gasoline it would deposit more of this substance on the piston head and interior of the combustion chamber. While this may be true of poorly refined benzol and when mixture proportions are not correct, it applies equally well when present low grades of gasoline are used and when the mixture of gasoline vapor and air supplied the cylinders is too rich.

The average carbureter will vaporize benzol at summer temperature but starting is harder in cold weather. The carureters fitted with heating arrangements for air are best, but as this is now almost universal practice in all automobiles owing to the low volatility of the gasoline used, it cannot be advanced as an objection to the use of benzol. In the early experiments carried out in England, it was found that the exhaust valve seats pitted more easily with benzol and air mixtures but this condition was attributed to the use of improperly refined fuel and the liberation of acid gases during combustion, which had a decided chemical effect on the hot valve metal. The price of benzol varies with locality, in many communities in this country it can be obtained only at drug stores but in general the average price is

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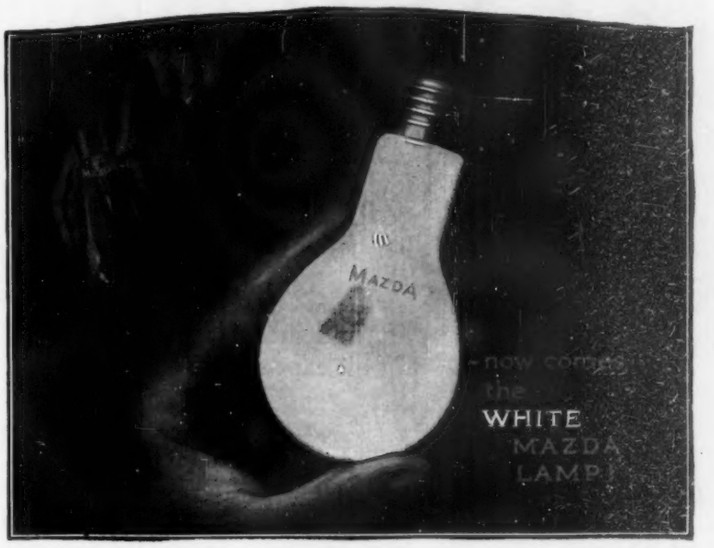

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higher than gasoline. Combination fuels, consisting of alcohol and benzol are being marketed in a few sections of the country where these substances are cheaper than gasoline because of local conditions. The Germans made considerable use of such combinations and experimented to determine the most economical proportions to use.

According to our Army Intelligence reports, many of the German army automotibles were being run on a mixture of benzol and alcohol during the war. As soon as Germany found herself cut off from outside supplies of gasoline a technical committee was appointed to find a substitute. Experiments were carried out with a Mercedes touring car equipped with an ordinary carbureter, when mixtures of alcohol and benzol were found to give satisfactory resulfs. Summarized the results obtained in these tests were as follows:

		Speed Obtained M. p. h.	Miles on 1 Liter of Fuel
Benzol	Alcohol		
1 part	1 part	42.2	4.66
1 part	2 parts	41	4.4
1 part	3 parts	39.1	4.3
1 part	4 parts	38.5	4.1
1 part	5 parts	36	3.7
Benzol only		41.6	3.79
Gasoline only		43.49	3.6

Calculating on the rates existing before the war, the benzol-alcohol mixture is the cheapest fuel obtainable. One liter of gasoline costs 9 cents, benzol 8.6 cents and alcohol 8.2 cents. The cost per kilometer works out as follows:

	Cents
Gasoline	0.0157
Benzol	0.01362
Alcohol-benzol 50 per cent	0.0125
Pure Alcohol	0.0167

This shows that a 50 per cent mixture of alcohol and benzol is the most economical and it is this fuel which had been used throughout the German motor transport service when gasoline could not be obtained. The only inconvenience experienced was the necessity of a preliminary heating of the carbureter. Starting the motor was a difficult task and on several occasions when the army had been retreating, automobiles were abandoned on this account. This difficulty was overcome by the obvious expedient of fitting a supplementary tank containing a small quantity of gasoline or ether. A three-way cock allows the auxiliary tank to be put into connection with the carbureter for starting purposes. As soon as the motor is warm the reserve volatile fuel is shut off and the alcohol-benzol mixture supplied to the motor. In case of a breakdown near the enemy's lines, or the loss of the main fuel supply through a bullet or piece of shell piercing the tank, the reserve supply was used. This was enough to take the vehicle 10 or 12 miles, which was generally sufficient to remove it from the danger zone.

New Engineering Work in France

A VERY expensive program for public works in France is now under consideration and plans have been drawn up for work on improvement of ports as well as for interior navigation and railroads. As to the guiding principle at the base of the enterprise, it is desired to increase the finances of the country by at least $3,000,000,000, quite outside of any war indemnities, and this is to be brought about by an increase in industrial and commercial facilities and a resulting development of international exchanges. On an after-war basis, the ports must be able to take care of the important sea traffic which is expected in the future, and this calls for an increase in the accommodations for the largest vessels, with all the corresponding outfit. A great port must also have sufficient warehouses to store the freight, and it is desired to establish manufacturing centers contiguous to the various ports in order to increase their traffic. The present idea is therefore to have well-organized ports, and then an extensive manufacturing district in the rear, all to be combined so as to work to the best advantage. This plan will require other railroads and waterways to be laid out on a sufficient scale to allow the traffic to develop at the same rate as the port traffic, *i. e.*, there must be the transportation facilities required to take off the material or products entering the port, and on the other hand to deliver to the port manufactured products or any other material intended for exportation.

Great attention is to be given to the Mediterranean port of Marseilles in order to make it a leading center of traffic as well as industry; it is in fact intended to make this one of the greatest ports of the world. The engineering work to be done here is of a most extensive character, and may be divided into two classes. In the first place the scheme for extension calls for new basins to be laid out along the coast in the line of the old basins (this work has already been commenced), while in the second place it is intended to take advantage of the natural resources of the region and to make use of two large inland lakes just back of the city. These will be connected with the sea and will thus be included in the port. Counting the sea line and the lakes, there will be a total of 20 miles of docks compared with 8 miles before the war. On the shores of the lakes it is proposed to erect numerous factories, and to organize a manufacturing district on the ideas which we mentioned above, this to be in close connection with the port.

The port of Algiers will be tripled in size to keep pace with traffic conditions. The project includes the layout of a great outer harbor which will accommodate the largest seagoing vessels, including warships. In addition to this the port will have two basins.

Parliament has already voted the program of constructing work for the coming needs of the port of le Havre. The tidal basin and its approaches will be deepened to 10 meters below the zero line, and this basin is to have an additional 1,000 meters of docks. The canal to Tancarville will be widened and deepened, and the construction work also includes two wet docks at the port. The bay of the Seine will be used in part, bounded by jetties, for laying out a new wet dock of considerable size to the east of the tidal basin. Here will be constructed (in the first place) about 3,000 meters of wharves. The proposed cost of the work at le Havre is $50,000,000, of which one-half will be paid by the Chamber of Commerce of that city, and it expects to cover this expense by local tolls on the merchant marine. Another project calls for extensive work upon the Rhone River from the threefold standpoint of electric power, navigation and irrigation. At the present time, the projects for all this work are being prepared, and soon the bill for the entire work can be submitted to Parliament. Especially significant are the plans for completing the Rhone navigation scheme by enlargement work on the canal from the Rhone to the Rhine, making it available for 300-ton canal boats, which at present cannot go all the way through. It is also intended to take every measure to turn aside the Alsace-Lorraine traffic from the course which it had before the war, and to bring it in the direction of France. It was considered a matter of urgent necessity to take up the construction of a heavy traffic waterway in order to bring the coal mines of La Sarre, the industrial plants of Upper Alsace, and the manufacturing centers of Strasbourg, Mulhouse and Bale, into connection with the basins of the Saone and Rhone, and the Mediterranean ports. The waterway is to be laid out so as to provide for the pasage of boats running on the Rhone and the Rhine and carrying 600 tons load.

Camel

CIGARETTES

CAMELS are unlike any cigarette you ever smoked—in quality, in flavor, in mellow-mildness *and in real satisfaction!* Any way you consider Camels they are a cigarette revelation! Camels meet your favor so completely you will want to smoke them liberally—and you can, without tiring your taste!

Camels are an expert blend of choice Turkish and choice Domestic tobaccos. This blend is so unusual, so delightful, you will prefer it to either kind of tobacco smoked straight! It will absolutely answer every wish you ever expressed for a cigarette made to meet your taste!

Camels have a smoothness that is as unique as it is refreshing. Yet, Camels have that *all there* body that gives satisfaction so generously. And, you'll enjoy Camels freedom from any unpleasant cigaretty aftertaste or any unpleasant cigaretty odor.

You'll quickly realize that you very much prefer Camels quality to premiums, coupons or gifts.

18 cents a package

Camels are sold everywhere in scientifically sealed packages of 20 cigarettes; or ten packages (200 cigarettes) in a glassine-paper-covered carton. We strongly recommend this carton for the home or office supply or when you travel.

R. J. REYNOLDS TOBACCO CO., Winston-Salem, N. C.

If Men Knew How to Lather, They Would Shave With More Comfort

SHAVING LATHER is applied to the beard for a double purpose. First—the soap removes the natural oil which covers each hair. Second—the water moistens and softens the beard, which it could not do if the oil were yet there.

A certain amount of gentle friction aids the lather in both operations of this double duty.

Lather mixed in a cup and brushed over the face does not properly soften the beard—there is not enough friction.

Rub the white Colgate Stick lightly over the wet face.

The still too common habit of "rubbing in" with the fingers gives too much friction, causing irritation and often a smarting face, for which soap or razor get unjust blame.

The logical way therefore is to make the lather on the face, where every motion of the brush both works it up and works it *in*. This gives enough friction to thoroughly soften the beard—and avoids the excess friction that may cause smart and burn.

No "mussy rubbing-in the lather" if you use COLGATE'S

But the soap you use is as important as the method of using it. One made with too much alkali will irritate your skin—one made with too little alkali will give a "slippery" lather that does not remove the natural oil.

More than a century of soapmaking has given Colgate & Co. the experience necessary to produce a neutral soap. But that is not enough—even that success did not satisfy Colgate & Co. They have gone still further and have now produced a form of shaving soap which gives you all this comfort—and adds thereto features of convenience and economy which no other shaving soap possesses.

As easy as putting a new blade in your razor.

Colgate's "*Handy Grip" Shaving Stick is constructed on a new principle. The soap is threaded—it *screws* into the metal grip instead of being fastened in. That same good Colgate Shaving Stick you've heard of for years!—with the added convenience of the "Handy Grip."

When you want a new supply, you need get only a Colgate "Refill" Stick—the soap alone—which is threaded to screw into the Grip, just as the original soap did. The process is as simple as putting a fresh blade in your safety razor or an electric bulb in its socket. This saves you the cost of a new metal box.

As a still further economy with Colgate's, the last half-inch or so can be *unscrewed* (using a knife-blade to unscrew the threaded soap) and pressed when wet to the top of the "Refill." It sticks—and can be all used—not a particle wasted. And this stub, usually thrown away, will, if used carefully, give you 50 extra shaves.

Lather with Colgate's Shave with comfort.

These are perhaps small economies—yes, but they are *real* ones because they save waste and needless expense—which is the basis of all thrift and efficiency, big and little.

Some men still prefer to shave with a Cream though it is the least economical way. To these men, this friendly word: Clip this paragraph and mail it to us before December 18th, 1919. We will send you, free, a trial tube of Colgate's Perfected Shaving Cream. You cannot be sure you know the best till you have used Colgate's. But we advise you to use our "Handy Grip" as the most convenient and economical way to shave. We can do this impartially as we make all three forms of shaving soap—Stick, Powder, and Cream. Address:

*Patented 1917

COLGATE & CO., DEPT. 40, 199 FULTON ST., NEW YORK

COLGATE'S

"HANDY GRIP"
PATENTED 1917

The Refill Shaving Stick

"Refill"; this name was coined to describe a full-size COLGATE'S Shaving Stick *threaded at the base* so as to screw into the metal "Handy Grip."

The shaving information in this Colgate advertisement was so cordially received when first published several years ago that it is now reprinted for other and new shavers. Please note also that Colgate & Co. originated and were the first to advocate "no mussy rubbing in" with the fingers.

HAVE YOU A SHAVING HOBBY?

Many men have—little short cuts and fancies that are not generally known. We heard of one man who lathers his face carefully and—washes it all off and starts over again. Another one wrote us that he re-lathers his face before his shower bath.

What is your hobby?

If you have one, write us about it. Who knows but you may have discovered something new to help make even a Colgate shave better! Tell us. In any event, get the *habit*—of shaving with Colgate's.